Volume 9 Labor Day to Matches

The GOLDEN BOOK ENCYCLOPEDIA

REVISED EDITION

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The GOLDEN BOOK ENCYCLOPEDIA

NEW REVISED EDITION

VOLUME 9—LABOR DAY TO MATCHES

IN SIXTEEN ACCURATE, FACT-FILLED VOLUMES
DRAMATICALLY ILLUSTRATED WITH MORE
THAN 6,000 COLOR PICTURES

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ESPECIALLY DESIGNED FOR
YOUNG GRADE-SCHOOL CHILDREN
ACCURATE AND AUTHORITATIVE
ENTERTAININGLY WRITTEN AND ILLUSTRATED
TO MAKE LEARNING AN ADVENTURE

BY BERTHA MORRIS PARKER
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RESEARCH ASSOCIATE, FIELD MUSEUM OF NATURAL HISTORY

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The letter *L* may have begun as the picture of an oxgoad. Scholars are not sure. The Phoenician way of writing it was 𐤋 . Greek forms of it, when they borrowed the alphabet from the Phoenicians, were ⅂ and V . When the Romans got the alphabet they changed the direction of the short stroke so that it was at a right angle to the long one. The letter has come down to us unchanged from the Romans.

In most words with an *L* the letter stands for the sound it has in *low* and *all*. But in some words it is silent. *Calm, salmon,* and *half* are three of them.

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LABOR DAY In the United States the first Monday in September is called Labor Day. It is a holiday set aside to honor the workers of the country. Labor Day is not a very old holiday. It dates back only to 1882.

All stores and banks are closed on Labor Day. So are offices and factories. Mail carriers do not make any deliveries. No evening newspapers are published. It is a holiday for all except a few workers whose work has to go on. Most people celebrate Labor Day by not laboring at all!

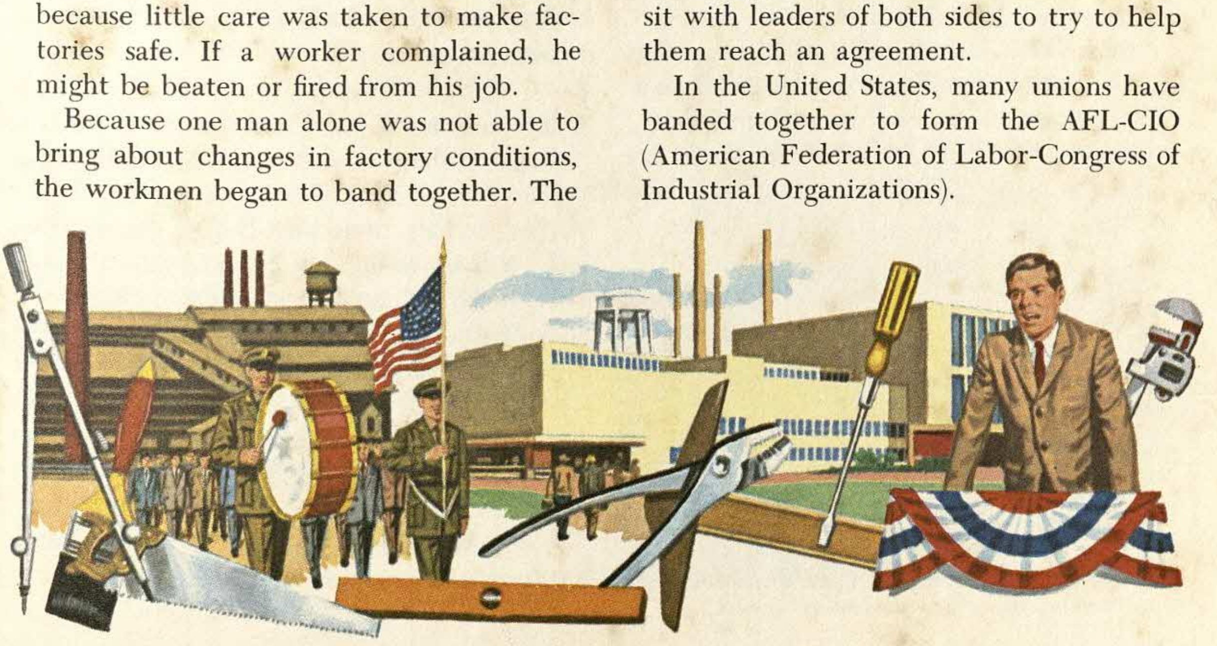
LABOR UNIONS Stories about factory conditions a century ago often describe the harsh way in which workers were treated. The working day was long, and the pay was poor. Sometimes the work was dangerous, because little care was taken to make factories safe. If a worker complained, he might be beaten or fired from his job.

Because one man alone was not able to bring about changes in factory conditions, the workmen began to band together. The groups, which came to be called labor unions, demanded better pay and better working conditions. If a factory owner did not agree to make the changes asked for, all the workers in the factory might leave their jobs. When workers walk off their jobs they are said to be on strike. Strikes sometimes led to bloody fighting.

Workers in many fields now have unions. About 18,000,000 of the workers of the United States are members of labor unions.

Labor unions still use strikes or threats of a strike to enforce their demands. But many troubles that used to lead to strikes are now settled by collective bargaining. In collective bargaining, union leaders try to work out agreements with the employers, or management. Government officials often sit with leaders of both sides to try to help them reach an agreement.

In the United States, many unions have banded together to form the AFL-CIO (American Federation of Labor-Congress of Industrial Organizations).



LACE Two and three hundred years ago it was stylish for men to wear wide lace collars, lace cuffs, and even lace rosettes on their shoes. Women wore much lace, too. A portrait painter of that time had to be able to paint lace well. All the lace in those days was handmade. Gradually men gave up the idea of wearing lace. But some women still wear a great deal, much of it on lingerie. Lace is used for curtains and tablecloths, too. Most of today's lace is made by machine.

Caps of a sort of crude lace were made in Egypt 15 centuries ago. But the kind of lace we know dates back only about 500 years. Lace can be made of different kinds of thread—linen, cotton, silk, wool, gold, silver, and nylon.

Different parts of the world became famous for their lace. Among the beautiful laces are Brussels from Belgium, Valenciennes from France, and Venetian rose point from Italy.

Some of the fine handmade laces are bobbin laces. Some are needlepoint.

The thread for bobbin lace is wound on long slender spools, or bobbins. The lacemaker has a pillow in front of her with many pins stuck in it, marking out the pattern to be made. She moves the bobbins about, twisting the threads in and out among the pins.

In making needlepoint, the lacemaker works with a needle and a single thread. The pattern is outlined on parchment.

Handmade lace can also be made by knitting, tatting, and crocheting. But lace made in these ways is all rather coarse.

Lafayette was only 20 when he came to America.

LAFAYETTE, MARQUIS DE (1757–1834) In 1777 the Revolutionary War had begun. The 13 American colonies were fighting to win their freedom. George Washington was their leader. His soldiers were not well trained and did not have good weapons. Their chances did not look bright. But in that year a young French nobleman came to their help. He was the Marquis de Lafayette.

Lafayette brought a ship well fitted out and a few good soldiers. He himself soon became one of Washington's best officers. During the war Lafayette went back to France for a while. But he returned with money and more soldiers. It may be that the Americans would not have won the war without his help.

"Marquis de Lafayette" was a title. Lafayette's name was Marie Joseph Paul Yves Roch Gilbert du Motier. His family was rich. As a boy Lafayette could have anything money could buy. But he chose, when he was 16, to be a soldier. He was still only 20 when he came to help America.

At the end of the war Lafayette went back to France. He took a very active part in the affairs of France. But France was in a state of turmoil. The common people had turned against the king and most of the nobles. Lafayette wanted the common people to have more freedom. But at the same time he was a nobleman. Eventually neither side trusted him. He lost most of his former friends and his money.

In 1792, in a war between France and Austria, Lafayette was captured by the Austrians. He was a prisoner until 1797. Napoleon, then the ruler of France, offered him a position, but he refused.

When Lafayette was nearly 70 he came to America for a visit. By this time the United States was prosperous. Lafayette was paid great honor, and Congress made him gifts of both land and money.

Americans have always felt that they owe a great debt to Lafayette. In World War I, after the first American troops landed in France, one of their officers said, "Lafayette, we are here."

LAKE DWELLERS The time of the cavemen is called the Old Stone Age. After it came the New Stone Age. Among the people of the New Stone Age were the Lake Dwellers of Switzerland.

The Lake Dwellers, who were living there more than 4,500 years ago, built their houses on the shores of deep lakes. They made foundations for their houses by driving piles down into the mud along the shore. The houses formed small villages. The Lake Dwellers had learned to live in groups.

These people of the New Stone Age used tools and weapons made of stone just as the cavemen did. But theirs were made of polished stone. They polished their tools and weapons by rubbing them with other pieces of stone.

In a number of ways the Lake Dwellers were ahead of the cavemen. From people living near the Mediterranean they had picked up many new ideas. They had bows and arrows. They knew how to make pottery. They could weave cloth, too, and sew it to make clothing. They could make fishnets for catching the fish that were in the lake at their front door.

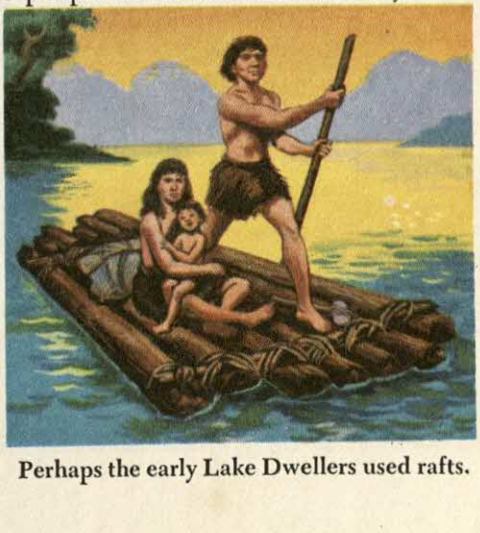
Most important of all, the Lake Dwellers were able to raise plants and animals for themselves. In their small fields they planted barley, millet, and flax. They had pigs, goats, sheep, cattle, and dogs.

Lake Dwellers lived in small villages.

These people of long ago did not have to spend most of their time hunting food. They had time to think of ways of making life easier and more pleasant. They had gone far on the road toward civilization. For many centuries, so far as scientists can tell, the Lake Dwellers lived in peace.

Scientists have known about the Swiss Lake Dwellers for only a little more than 100 years. In 1853 the first ruins were found in a lake near Zurich. Since then scientists have found other ruins.

Although the Swiss Lake Dwellers are the best known of the lake dwellers, there have been lake dwellers in many parts of Europe at many different times. There have been lake dwellers, too, in other continents besides Europe. And some primitive people are lake dwellers today.



Perhaps the early Lake Dwellers used rafts.

LAKES The bodies of water we call lakes are just the opposite of islands. They are, that is, bodies of water with land all around them. They are like ponds except that they are bigger.

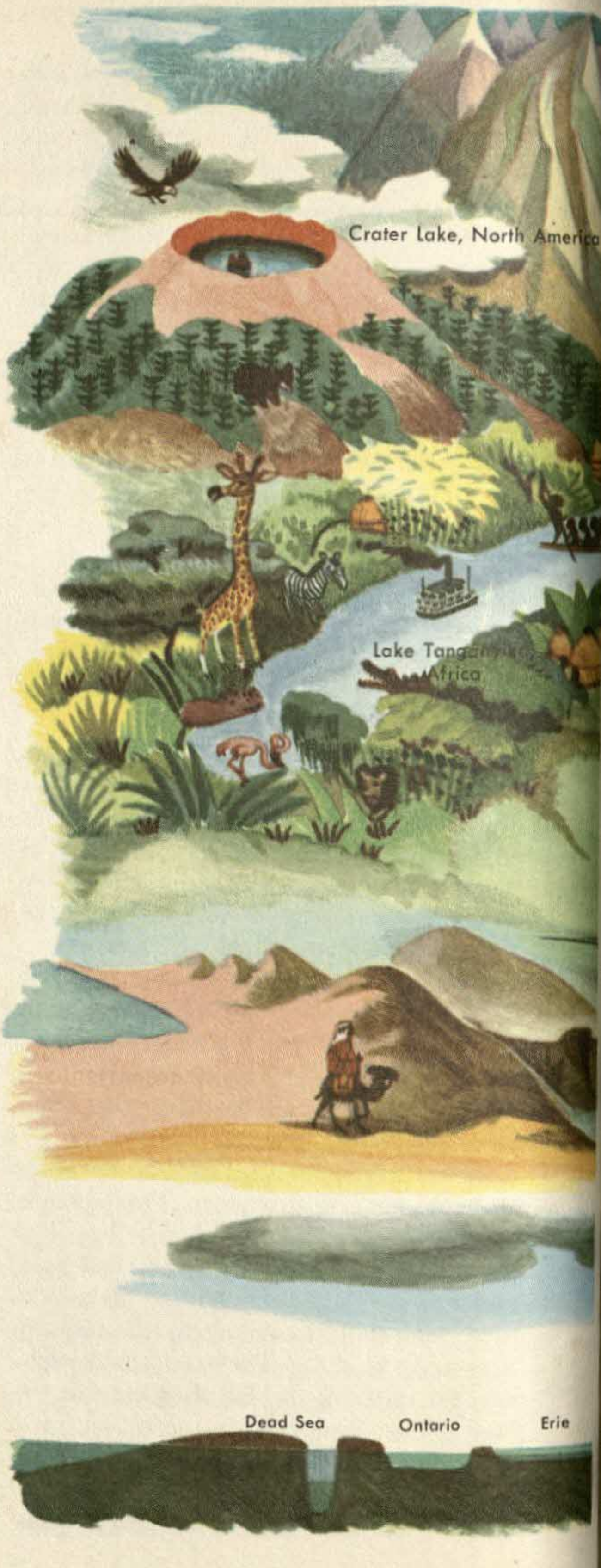
Most lakes have fresh water in them. But some have salt water. Water keeps running in and out of freshwater lakes all the time. Water runs into salt lakes, but it does not run out of them. They do not overflow, because the water in them evaporates as fast as it is brought in. In some cases it evaporates faster and the lakes get smaller. All the salt brought to the lakes stays there. Salt lakes are found only in dry regions. Because they are salty they are sometimes called seas.

Great Salt Lake, Lake Aral, the Caspian Sea, the Dead Sea, and Lake Van in Turkey are five of the well-known salt lakes. Of these the Caspian Sea is by far the largest. It is more than five times as large as any freshwater lake.

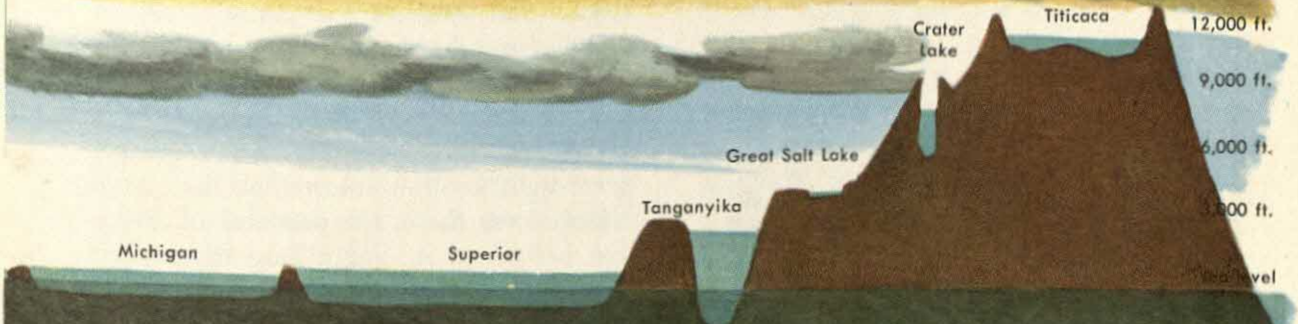
The list below gives the names of the 12 largest freshwater lakes. All five of America's Great Lakes are in the list.

LAKE	LOCATION	AREA IN SQ. MI.
Superior	North America	31,820
Victoria	Africa	26,828
Huron	North America	23,000
Michigan	North America	22,400
Baikal	Asia	13,197
Tanganyika	Africa	12,355
Great Bear	North America	12,200
Nyasa	Africa	11,000
Great Slave	North America	10,719
Erie	North America	9,940
Winnipeg	North America	9,460
Ontario	North America	7,540

The "bowl" that holds a lake is called the basin of the lake. Lake basins are formed in a number of ways. Glaciers—sheets or rivers of ice—helped form a great many. Minnesota, for instance, would not be the "Land of 10,000 Lakes" if it had not been for the glaciers of the great Ice Age. Some of the lakes of today men have made by damming rivers.



Lake Titicaca, South America
Great Salt Lake, North America
Lake Nipig
Lake Superior
Lake Michigan
Lake Huron
Niagara Falls
Lake Erie
Lake Ontario
Dead Sea


Crater Lake
Titicaca
12,000 ft.
9,000 ft.
6,000 ft.
Great Salt Lake
Tanganyika
3,000 ft.
Michigan
Superior
Sea level

Some lakes are deeper than others. Lake Winnipeg in Canada is less than 100 feet deep, while Lake Baikal in the Soviet Union is about a mile deep.

In the earth's long history many lakes have disappeared. Some have simply dried up. Some have been filled with mud washed into them and with plants that spread out from the shores as the water grew shallow. Many marshes are lakes in their last stages. Some lakes have been drained when the rivers running out of them cut their beds down to the level of the bottom of the lake. There is a great deal of truth in the old saying, "Rivers are the mortal enemies of lakes." (See CASPIAN SEA; CRATER LAKE; DEAD SEA; GREAT LAKES; GREAT SALT LAKE; TITICACA.)

LAMPS AND LIGHTING The cave dwellers could not light up their caves by pushing a button, pulling a chain, or lighting a lamp with a match. In the beginning the only light they had at night was moonlight or the light of a bonfire.

Now we can turn night into day both indoors and outdoors. City streets and even many village streets are lighted all night long. Factories are so well lighted that work can go on for all 24 hours of a day. Lights in ball parks let games be played at night. Almost no work or play has to stop because of darkness. The pictures show some of the many steps in the story of lamps and lighting.

The first torches were just flaming sticks. Probably the very first torch was a stick some caveman pulled out of his bonfire. Later, people found that a torch gave better light if the end was dipped in animal fat or pitch. Racks were put on walls to hold torches in place.

The discovery that melted fat or oil will travel up a wick was a great step forward in the story of lighting. Wicks made candles and oil lamps possible. The first wicks were probably made of moss or rushes. Later, wicks were made of threads twisted or woven together.

In a candle the heat of the flame makes a little of the candle wax melt. The melted wax is soaked up by the wick and burns at the end of the wick. The flame is bright because there are tiny white-hot particles of carbon in it. As a rule these tiny particles burn up. When a flame is smoky, it means that some carbon particles are escaping from the flame without burning.

In an oil lamp the oil is already a liquid. It does not have to melt before it travels up the wick. The flame gives a good light for the same reason the candle flame does; there are particles of white-hot carbon in it. For a long time whale oil was the oil people liked best for their lamps. Then kerosene, or coal oil, took its place in many parts of the world.

Glass chimneys made oil lamps much better than the earlier ones had been. A chimney protected the flame from the wind and helped to keep a stream of air moving to the flame. The flame got enough air to burn well.

Kerosene lamps were much used both indoors and outdoors. Those for outdoors were called lanterns.

Of course, a lantern did not have to be a kerosene lantern. It could use some other kind of oil. Or it could have candles in it. Perhaps the strangest lanterns ever used were firefly lanterns. Big fireflies were caught and put in them.

Gasoline and acetylene lamps are other lights that were once fairly common. Acetylene is made from water and calcium carbide. More than 100 years ago natural gas came into wide use as fuel for lighting. Gas from coal was often used instead. Gas had to be piped to the lamps built for it. Gas lamps, therefore, could not be carried from place to place. But they made good streetlights and wall and ceiling lights.

Torches, candles, oil lamps, and gaslights all seem old-fashioned now. Electric lights have almost crowded them out.

There are several different kinds of electric lamps—arc, incandescent, neon, fluorescent, and others besides. They are all different in one important way from the kinds of lamps that were used before them: in an electric lamp nothing is on fire.

In arc lights electricity produces light by flowing from the end of one carbon rod to the end of another a short distance away. In incandescent lamps a tiny metal wire gets white-hot, or incandescent, when a strong current of electricity flows through it. In neon and the similar mercury-vapor and sodium-vapor lights the current makes a gas glow. In fluorescent tubes the current makes a chemical coating on the inside of the tube give off light.

There are many types of lamps that are not primarily for lighting. Among the most interesting are the black-light lamps. The "light" from these lamps makes certain chemicals glow. Often they are used in displays of minerals and in advertising.

Firefly lanterns were not very good. But fireflies have a secret which scientists have been trying to discover for use in lamps. Fireflies give off light without giving off noticeable heat. Their light is sometimes called cold light. All the ways of lighting in which fire is used are bound to give off heat as well as light. Arc lights and electric lamps with filaments that get white-hot give off heat, too. Neon and fluorescent lamps come close to being like firefly lights. They give off little heat.

The story of lamps and lighting has not ended. Scientists are trying to find even better ways of changing night into day. (See CANDLE; EDISON; ELECTRICITY; LIGHT; LIGHTNING BUG.)

LANGUAGES The story of languages should begin with the story of how men first learned to talk. But of course no one knows. We can be quite sure, though, that no one person invented language. No one of our early ancestors suddenly thought of a way of making words and sentences and then taught all those he met to talk the way he did. Instead, language must have developed little by little.

Perhaps the first words were exclamations such as "oh" or "ow." These may have been cries of pain or warning. Perhaps the first words were easy sounds such as "yo ho." Men may have used them as signals to one another when they were trying to lift a log or were about to attack a mammoth. Perhaps, but it is not at all likely, the first words were imitations of sounds our early ancestors heard around them.

Once language began, people found that they could work together much more easily when they could talk with one another. They could make plans for their work, too.

Even after language began, people probably did much of their talking with gestures. But Mrs. Charles Lindbergh tells a story which shows that gestures are of no use for some ideas.

She and Colonel Lindbergh had landed near a Japanese fisherman's cottage. They were hungry. They could not speak Japanese. They had no trouble, however, making the fisherman understand that they would like to have some fish to eat. Colonel Lindbergh simply drew a picture of a fish. Then both he and Mrs. Lindbergh pointed to their mouths. But after they had eaten the fish they could not say thank you.

Language may have started in one place and spread from that place. Probably, instead, it started in several places. In any event, if the peoples of the world had been in close touch with one another all through their history, we might now have only one language. But mountains and seas have kept peoples apart. So have hatreds. Today there are more than 1,000 languages. Some are spoken by many millions of people, others by only a few thousand. The list below names some of the world's languages. It tells, too, about how many people speak those languages.

LANGUAGES OF THE WORLD

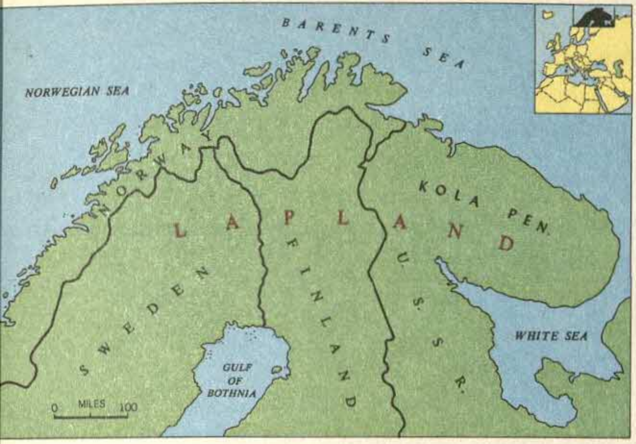
Mandarin (China)	555,000,000
English	309,000,000
Russian	183,000,000
Hindi (India)	178,000,000
Spanish	174,000,000
German	120,000,000
Japanese	101,000,000
Arabic	94,000,000
Bengali (India, Pakistan)	94,000,000
Portuguese	93,000,000
Malay-Indonesia	78,000,000
French	74,000,000
Italian	58,000,000
Urdu (Pakistan, India)	55,000,000
Korean	41,000,000
Turkish	35,000,000

(See ENGLISH LANGUAGE; LATIN; UNIVERSAL LANGUAGES.)

LAPLAND The name Lapland means land of the Lapp people. The Lapps have a language of their own, but not a separate country. Lapland stretches across northernmost Norway, Sweden, and Finland and on for a way into the Soviet Union.

Lapland is so far north that winters there are long and cold. In midwinter there is no daylight. But Lapps learned long ago how to make a living in their land by herding reindeer. Reindeer moss and other lichens grow there. Reindeer can live on these plants. The Lapps get milk from their reindeer. They get meat, too. They make

Lapp Children Riding on a Reindeer Sled



shoes, clothes, and tents from the skins of the reindeer that they kill for meat, and they make tools from the bones. They also use reindeer to pull their sleds.

Lapp herders live in tents in summer, because tent homes are easy to move. The herders must move about to find enough pasture for their herds. Their winter homes are made of stones or birch boughs covered with earth.

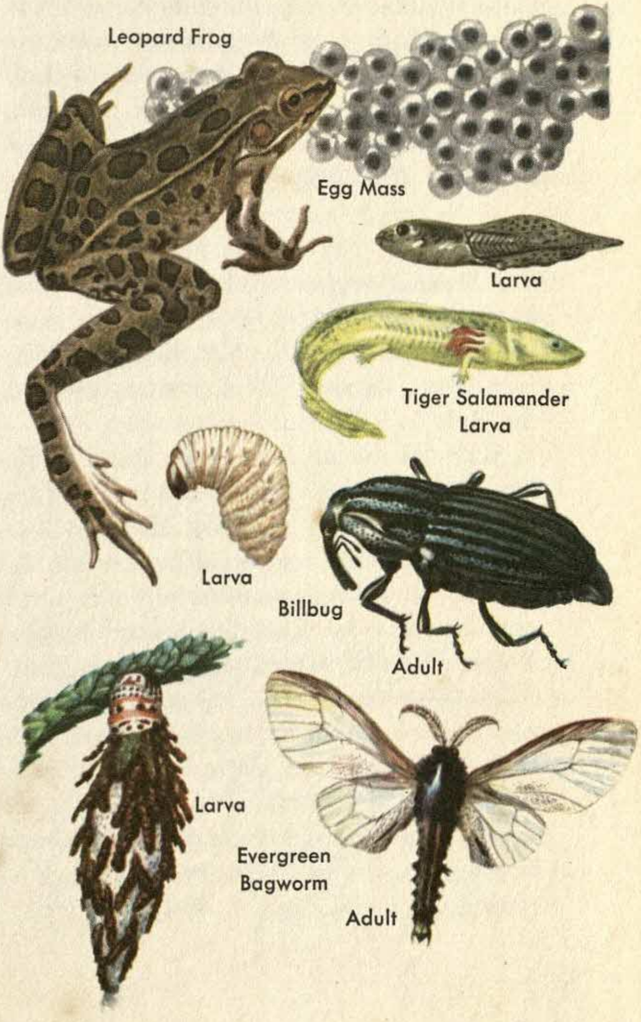
In recent years many changes have been made in Lapland. Rich iron ore has been found in some places. The chief mines are in Sweden. The iron-mining city of Kiruna, 90 miles north of the Arctic Circle, is the center for excursions into Lapland. In the small city there are good hotels. Some of Lapland's scenery is spectacular.

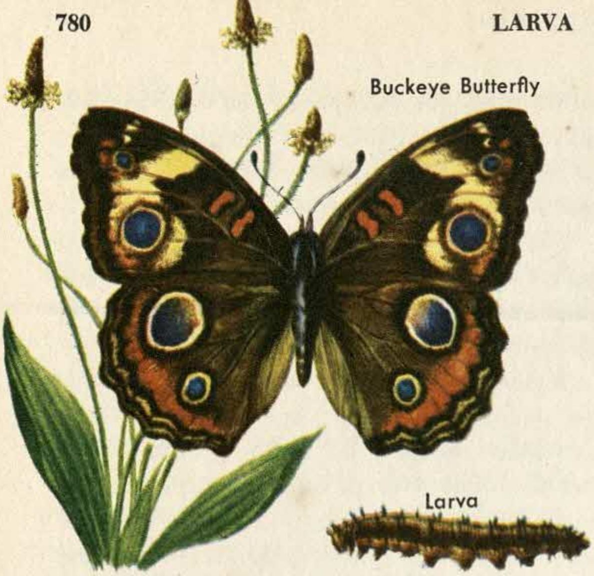
Norway, Sweden, and Finland have all spent big sums on new roads, power plants, and schools in Lapland. Now, as before, many Lapps are fishermen. Others have little farms in river valleys. But reindeer herding is still important. A Lapp may own several thousand reindeer. Some Lapps tend their big herds from helicopters. They have been called "cowboys of the sky."

LARVA The young of many animals look nothing like their parents. A wormlike buckeye caterpillar, for instance, looks nothing like the beautiful butterfly that laid the egg from which the caterpillar hatched. Among other young animals that do not look like their parents are small white maggots, fat grubs, and fishlike tadpoles. The maggots are young flies, the grubs are young beetles, and the tadpoles are young toads or frogs.

Caterpillars, maggots, grubs, and tadpoles are larvas. The young of all animals that change greatly in appearance during their lives may be called larvas.

A surprisingly large number of animals go through a larval stage. Some of them are land animals: butterflies, moths, flies, beetles, bees, wasps, and ants. Some are water animals: starfish, oysters, lobsters, and barnacles. Some animals spend the larval part of their lives in water and their adult lives on land: mosquitoes and most salamanders, toads, and frogs. Some tiger salamanders produce young without ever changing to the adult form. They never grow past the larval stage. There are other similar cases.





Insect larvas become pupas on their way to becoming adults. Other larvas do not.

The larvas of some insects are pests. Many caterpillars and grubs greatly damage trees and crops because of their huge appetites. Some insects eat only when they are larvas. Luna, cecropia, and polyphemus moths are three large moths that do not eat in their adult stage. They may go three or four weeks without food before they die. (See ANIMAL BABIES.)

LA SALLE (1643–1687) We call one of the famous explorers of the New World La Salle. But that was not really his name; it was a part of his title. His real name was René Robert Cavelier. His title was Sieur de la Salle.

Many of the explorers who came to the New World were poor. They had nothing —at least nothing but their lives—to lose. La Salle's family was wealthy. He set out for America because he loved adventure and because he had dreams of helping France to build a great American empire.

La Salle was given some land along the St. Lawrence River near Montreal. He built a village there. From friendly Indians he heard of great rivers to the south and west. He made up his mind that he would explore the region they flowed through as soon as he could.

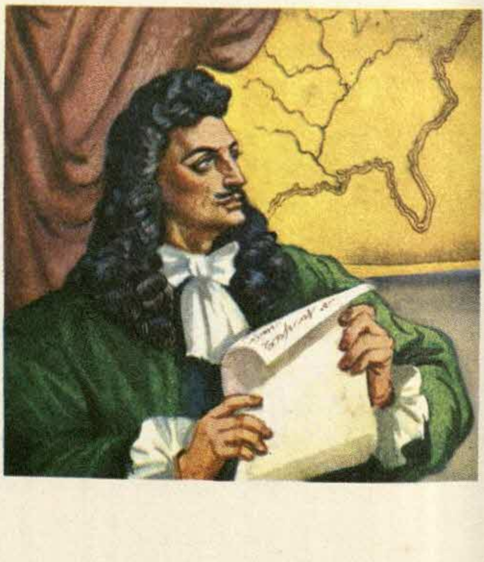
After some trips south of Lake Erie, he was sent to France by the French governor of Canada. Back in Canada, he heard that Joliet and Father Marquette had traveled down the Mississippi almost to the Gulf. He began at once to make plans to go all the way to the mouth of the great river and to claim the land along it for France.

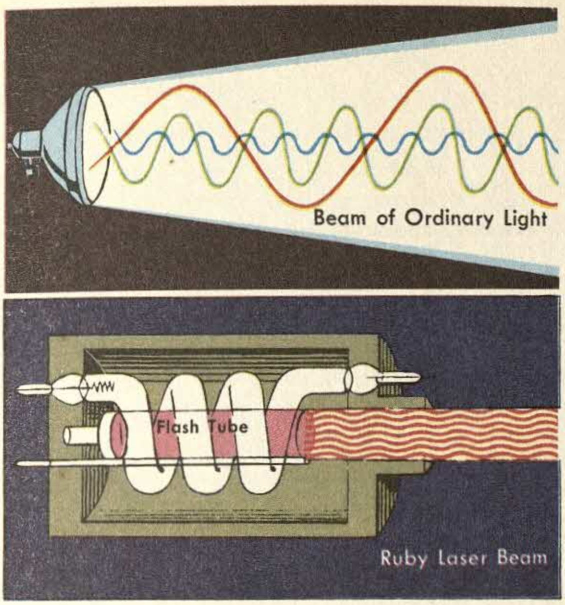
When he tried to carry out his plans he had much bad fortune. But at last, in 1682, he and a small party traveled in canoes down the Mississippi to the Gulf.

On a little island near the mouth of the Mississippi the men fired their muskets and shouted and prayed. They erected a sign saying that the land they had traveled along now belonged to King Louis XIV of France. La Salle named the region Louisiana.

La Salle again returned to France. He started back with four ships and about 400 men to build forts and make settlements along the Mississippi. On the way he was delayed by illness. He lost his supply ship and many of his men. He had planned to reach the mouth of the Mississippi by sailing along the coast of the Gulf of Mexico, but he failed to find it. In the wanderings that followed, the party faced great hardships. Finally La Salle's men mutinied and killed him.

In 1803 the United States bought much of the land La Salle had claimed for France. This land was called the Louisiana Purchase. (See EXPLORERS; MISSISSIPPI RIVER.)





LASER The word laser is new to a great many people. But, if lasers can do all that scientists now expect them to be able to do, it will soon be as well known as "electronics" and "astronaut."

An ordinary lamp sends out rays of different colors and wavelengths. The rays, moreover, spread out. A laser sends out parallel rays all of the same wavelength and in step with one another. Scientists have actually sent a laser beam all the 240,000 miles to the moon. There it spread over a circular area about two miles across. If a beam from an ordinary searchlight could be made powerful enough to reach the moon, it would spread over an area thousands of miles wide. The beam from a laser can be focused into a spot less than 1/10,000 of an inch in diameter.

A ruby laser has in it a rod of synthetic, or man-made, ruby. When the flash tube flashes, the ruby rod sends out a beam of intense red light. Not all lasers have ruby rods. At least 100 different materials have been used. And the beams are not all red. Lasers that send out blue-green beams help in underwater exploring.

Drilling holes in steel, welding metals, helping in surgery, tracking satellites, making three-dimensional photographs, and carrying thousands of telephone messages on a single beam—these are some of the tasks scientists have set for lasers. And lasers are expected to help with simple tasks, too. One scientist has invented a laser eraser. With it he can erase a misspelled word without leaving a trace!

LATIN The language spoken by the ancient Romans is called Latin. No one speaks Latin in everyday conversation now. It is a dead language. But a number of the languages of today came from Latin. Italian is one. French, Spanish, Portuguese, and Rumanian are others.

Mica, mica, parva stella
Miror quaenam sis tam bella.

This rhyme is in Latin. Translated into English it says:

Twinkle, twinkle, little star
I wonder why you are so beautiful.

The English alphabet came down without much change from the Latin alphabet. And many English words can be traced back to Latin words. "Mica," for instance, is the English name of a shiny mineral. "Constellation" has the Latin word *stella* in it. "Miracle" comes from *miror*, and "belle" from *bella*.

Long after people stopped speaking Latin in their everyday talking, it was the language of the scholars. Almost all the books written in Europe during the Middle Ages were written in Latin.

Until recently much of the service of the Roman Catholic Church was in Latin. "Adeste Fideles" is a well-known hymn. Its Latin name means, "Come, ye faithful."

Latin is still much used by scientists. Every known kind of plant and animal has a Latin name. Its Latin name is called its scientific name. The scientific name of the common toad is *Bufo americanus*. The scientific name of corn is *Zea mays*. Man's scientific name is *Homo sapiens*.

Many students still study Latin. Knowing Latin helps them understand their own language better. (See LANGUAGES.)

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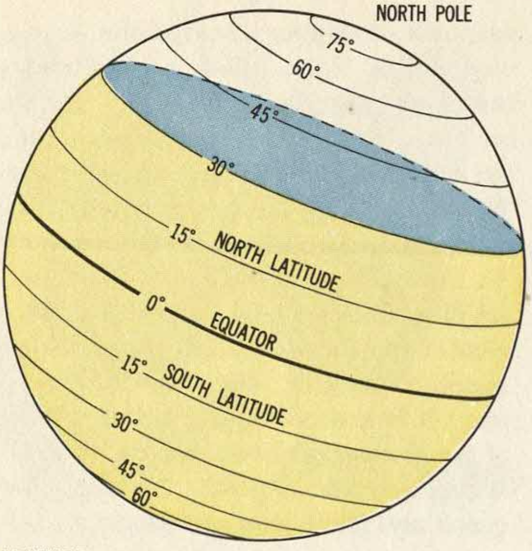
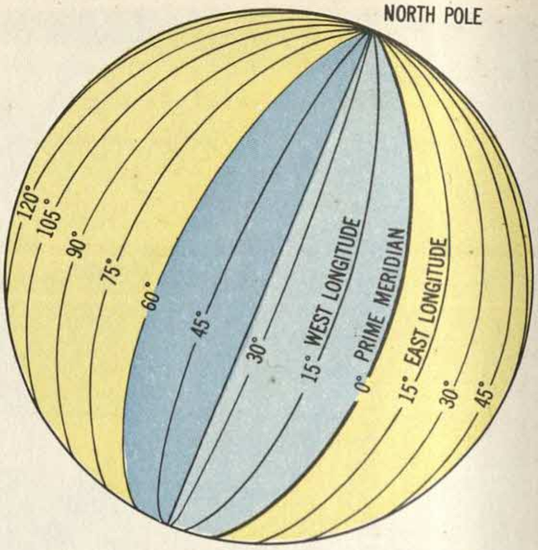


LATITUDE



LONGITUDE

LATITUDE AND LONGITUDE A visitor asking directions in a strange city may be told that a certain building is at the corner of Main Street and Pine Avenue. Streets that cross one another furnish us with a fairly easy way to give directions in a city. But the whole earth is not divided up into a checkerboard of streets. And on thousands of square miles of ocean there are no landmarks of any kind. We therefore use imaginary lines to help us give exact locations. The globes pictured show some of these imaginary lines.

A ship crossing the Atlantic Ocean, let us suppose, is in trouble. The captain sends out a radio call for help, and tells where the ship is. He gives the ship's location on the great expanse of the ocean by telling its latitude and longitude. Telling the ship's latitude and longitude means telling which of these imaginary lines meet at the spot where the ship is. Naming the latitude tells how far north or south of the equator the ship is. Naming the longitude gives its position east or west of a line called the prime meridian.

The equator, as most people know, is an imaginary circle around the earth just halfway between the North Pole and the South Pole. The prime meridian is an imaginary half-circle running from the North Pole to the South Pole through Greenwich, a town near London, England.

The ship in trouble, we will say, is at 30° N. and 45° W. The "30° N." tells the latitude of the ship. The "45° W." tells its longitude. The sign "°" stands for "degrees." Every circle, big or little, may be thought of as divided into 360 degrees. Most clock faces are marked off into 60 spaces that stand for minutes of time. If the space between every two of the little marks were divided into six equal parts, we would then have a circle marked off into 360 degrees. All the imaginary latitude and longitude lines are circles or half-circles. It is natural, then, that degrees are used in telling positions on the earth.

On the first globe the equator is marked clearly. The other circles shown are called parallels because they are all parallel with the equator. Parallels could be drawn for every degree. But so many parallels would clutter up a map. The parallels on this little globe are 15 degrees apart.

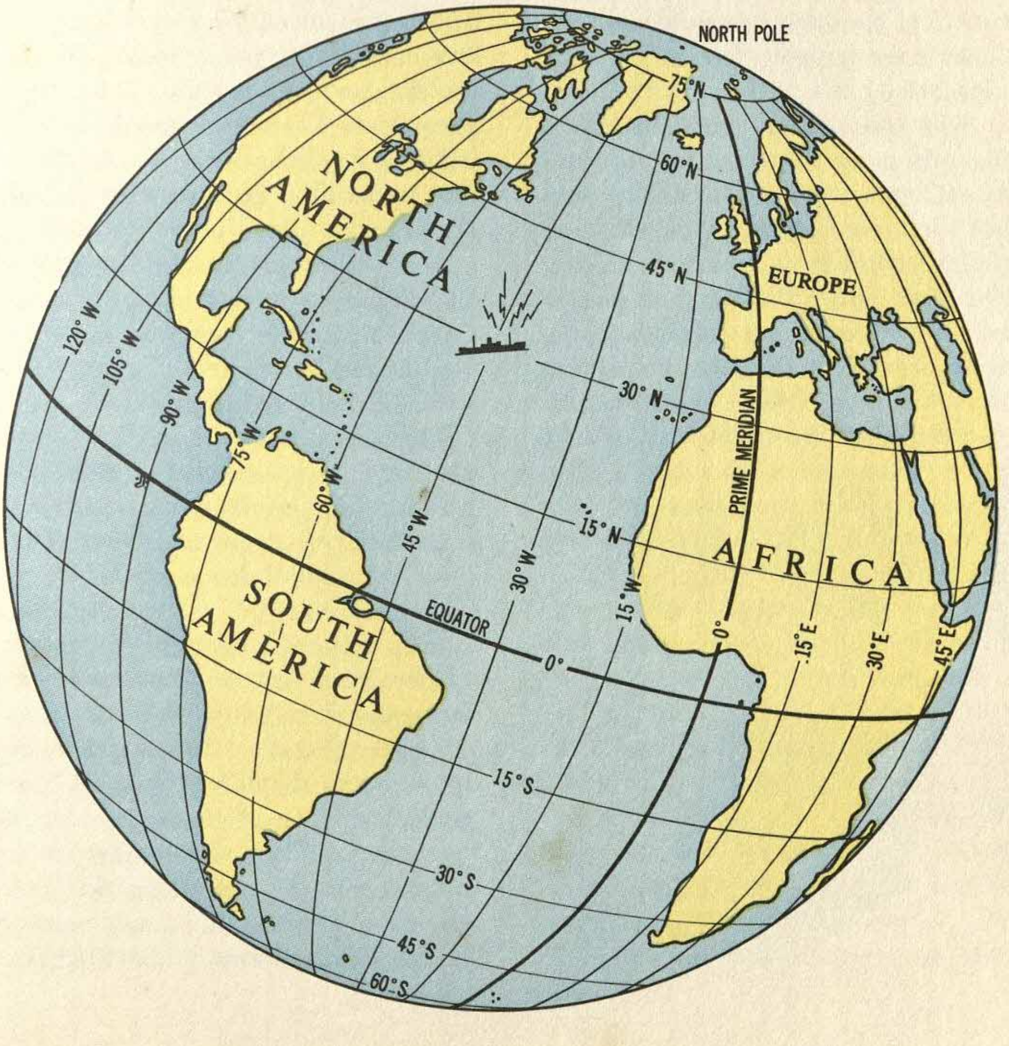
On the second globe the prime meridian is marked. The other lines are simply called meridians. All meridians are half-circles. They all run from pole to pole. The meridians all meet at the poles and are farthest apart at the equator. The meridians shown are 15 degrees apart.

The third globe has both parallels and meridians. The little ship at 30° N. (30 degrees North Latitude) where it meets 45° W: (45 degrees West Longitude) marks the place of the imaginary shipwreck.

Imaginary lines cannot be seen. It is, then, not at all easy for the captain of a ship in the middle of an ocean to tell what his latitude and longitude are. Among his helps are very accurate clocks, or chronometers, and instruments to take sights of the sun and stars. He also has the help of radio and of navigation satellites.

Many maps have parallels and meridians on them. On such a map of the United States it is easy to see, for instance, that New Orleans is at almost exactly 30° N. and 90° W. From knowing the latitude and longitude of a place, people who have studied geography can tell a great deal about the climate and other conditions of the place without ever having seen it.

Degrees on the earth can be changed into miles, but one needs a special table to do this. A degree is a part of a circle. If a circle is big, therefore, a degree will cover a greater distance than will one on a small circle. A glance at the first globe shows that the circles we call parallels get smaller the nearer they are to the poles. On different parallels, then, a degree stands for different numbers of miles. On the equator a degree is about 69 miles, on the 75th parallel only 18 miles. The meridians all measure the same, but degrees vary a little because the earth is slightly flattened at the poles. They are roughly 69 miles. (See CLOCKS AND WATCHES; MAPS.)



LAWS Every game has a set of rules. Imagine baseball without rules. There would be so many arguments that a game would never end. Living together in a group also requires rules. Some of them are so important that they have been made into laws. Laws have a great deal to do with our daily lives.

In ancient times rulers made the laws. A ruler might make a law that seemed unfair, but there was nothing his people could do unless they rose up against him. Now in most places people have a share in making their own laws. In the United States people are elected to make the laws. This is a plan that is being adopted more and more throughout the world today.

Even though we have a chance to help make our own laws, not all of us agree when one is made that it is good. If enough people are in favor of it, a law can be passed even if others do not like it.

If everyone agreed that all our laws were good, the laws might never be broken. Those that grew out of customs are not as likely to be broken as those that did not. But almost every law is broken sometimes. There have to be, therefore, courts where people who break laws can be tried.

A person who lives in a town or city in the United States is under at least three "layers" of laws. First of all there are the laws of his town or city. They are sometimes called ordinances. New ones are passed by city councils or town boards. Then there are the laws of his state. They are called state laws. They are passed by the state legislature. Above them all are the laws of the nation. They are federal laws. New ones are passed by the United States Congress.

The people elected to Congress in the United States cannot make just any laws they choose. The country has a constitution. No law can be enforced that does not fit in with the Constitution.

There are international laws, too. The new age of space and atomic power is creating new needs for such laws.

Laws may become out of date. There was once an English law saying that when a "horseless carriage" went down a road, a man had to walk in front of it with a red flag or a red lantern! Out-of-date laws can be repealed, or taken off the books.

In the history of the world some early rulers made themselves famous by writing down the laws of their countries so that everyone could know them. Two of the most famous were Hammurabi, a king of Babylonia, and Justinian, a Roman emperor. (See BABYLONIA; ROMAN EMPIRE.)

LEAD Most people think that they know how lead looks, for they have seen the lead in lead pencils. But the "lead" in lead pencils is not lead; it is a material called graphite. Graphite is not a metal. Real lead is. For a metal, lead is soft. It can be scratched with a person's thumbnail. Sheets of it can be cut with scissors. The freshly cut edge of a sheet of lead is silver-colored. But soon after the air reaches it, it becomes a dull gray. The word "leaden" is often used for dull gray.

"As heavy as lead" is a common saying. Lead *is* heavy. It is far heavier than iron or tin or aluminum. But it is not by any means the heaviest metal. It is not nearly as heavy as gold, and only about half as heavy as platinum. But it is so much cheaper than gold and platinum that many more people have a chance to lift a good-sized piece of it.

Lead is very useful partly because it melts easily. Of course, it does not melt as easily as paraffin or ice, but it melts much more easily than iron or platinum or gold. The melting point of lead is about 621° F. Gold melts at 1,945° F., iron at 2,795° F., and platinum at 3,224° F.

Lead is often melted and poured into different shapes. Pieces of sculpture have long been made by pouring melted lead into molds. The metal used in casting type for printing is mostly lead. Because lead is used in making type for printing newspapers and books, some people say that it has had more to do with the progress of civilization than iron or silver or gold.

People have known about lead for thousands of years. It was the first metal people learned to smelt from its ores. One of the early uses of lead was to make water pipes. Lead pipe lasts a very long time. Some of the water pipes made by the ancient Romans have lasted for 2,000 years. The Latin word for lead is *plumbum.* The English word "plumbing" comes from this Latin word. Plumb lines that builders use to be sure their walls are straight got their name from the heavy lead weights on them. The chemical symbol for lead comes from the Latin name. It is Pb.

The early settlers in the United States had pots and pans of pewter. Their pewter was a mixture of lead and tin. Solder, which we use in fastening two pieces of metal together, is also made of lead and tin.

Today a large part of the lead we use goes into storage batteries. Much is used, too, in covering for electric cables. Some lead serves to weight down the suits of deep-sea divers. An important use is in shields against X rays and the radiation in atomic power plants.

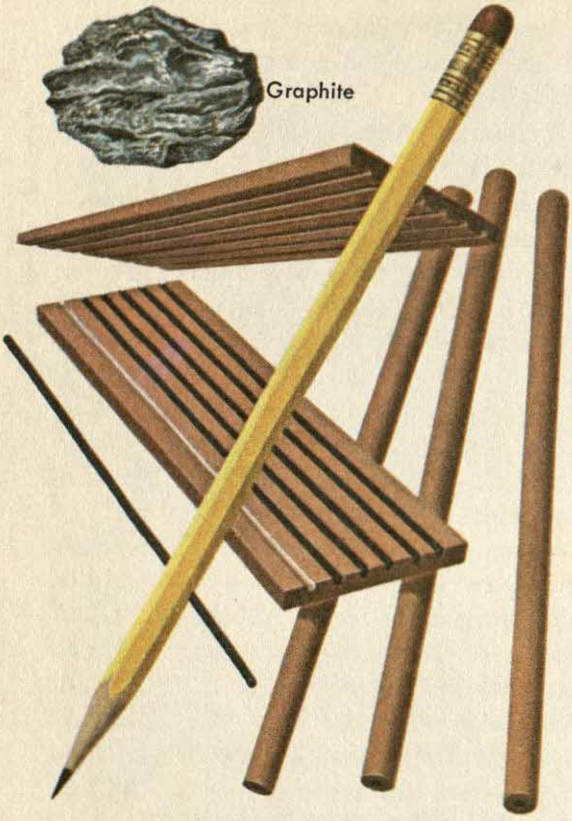
There are many compounds of lead—substances in which lead is joined with other materials. Some go into paint and some into special kinds of glass. Some go into antiknock gasoline.

Working with lead for a long time may be dangerous. Workmen sometimes become very ill from lead poisoning. Many children are poisoned by eating lead paint.

Most lead comes from an ore called galena. Galena, as the picture shows, forms pretty silvery crystals.

The United States is one of the leading lead producers of the world. But it uses even more than it produces. Therefore it has to buy some of the lead it needs from other countries. (See ALLOYS; COMPOUNDS; ELEMENTS; METALS.)

CRYSTALS OF GALENA



LEAD PENCIL How hard a day in school would be without a lead pencil! Of course, we could write with slate pencils on slates as some of our grandparents did. We could write with pen and ink as people have done for thousands of years or with ball-point or other modern kinds of pens. But lead pencils are more convenient. The marks they make can be erased easily. Millions of pencils are used up every year.

Lead pencils have no lead in them at all. The "lead" is a slender stick of a black material, graphite, mixed with clay. It is soft and smooth enough to rub off when it is moved across paper. The softer the lead of a pencil is, the broader, heavier mark it makes. Hard pencils make thin, sharp lines. Hard lead has more clay mixed with the graphite than soft lead. The best wood for pencils is incense cedar. A pencil made of it is easy to sharpen.

The lead for pencils is made in this way: Clay, powdered graphite, and water are mixed into a kind of dough. This dough is squeezed through holes in a metal plate. From each hole comes a tiny rope of the dough. This rope is straightened out and cut into pieces. The pieces are then baked, or fired, for several hours in an oven, or kiln, to drive out the moisture. They are hard, slender sticks when they come out.

Pencils are usually made six at a time. Six parallel grooves are made in thin slabs of wood cut pencil length and just the right width for six pencils. Six leads are laid in the grooves of one slab and another slab is put on like the top of a sandwich and glued in place. The pencils are cut apart and coated with lacquer. Many then are tipped with erasers.

Colored pencils are made in much the same way. But of course the "leads" contain colored substances instead of graphite.

LEANING TOWER OF PISA Many people know nothing about the Italian city of Pisa except that the Leaning Tower is there. The Leaning Tower is a bell tower. The bells are at the very top. The Tower is a beautiful building. It is built of white marble, and its many slender columns give it a lacy look. But the Tower is famous not so much for its beauty as for the fact that it looks as if it were about to fall over. It has, however, stood for over 600 years.

The Tower took 174 years to build. It began to lean long before it was finished. The foundation was not built on firm enough

ground. But the builders went on adding story after story until it was 179 feet tall. Since it was finished it has leaned more as the years went by. It is now 17 feet out of line. The center of weight—scientists call it the center of gravity—is still above the base of the Tower. As long as it stays above the base, the Tower will not fall. But many scientists believe that it will fall in 100 years or so unless it is kept from tilting further. Suggestions from engineers all over the world are being considered.

The Leaning Tower made a name for itself in one more way. Galileo is said to have performed one of his most famous experiments from it. (See GALILEO.)

LEATHER All real leather is the skin, or hide, of some animal. The skin has been cleaned and treated so that it will last a long time. Most leather comes from cattle, goats, and other animals with hair. But some leather comes from snakes, lizards, and alligators. Even the skins of ostriches and frogs can be made into leather.

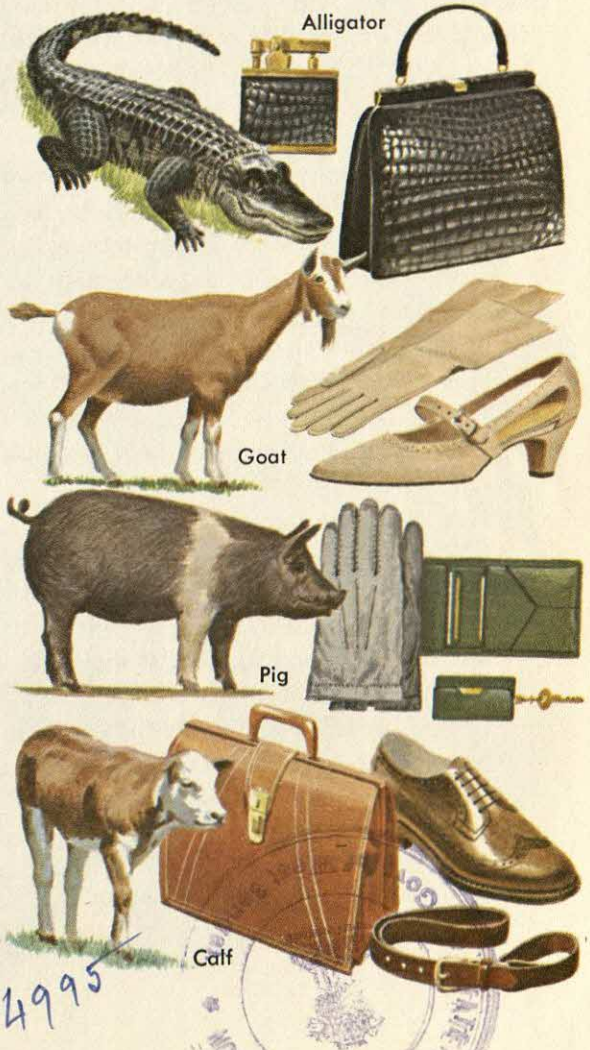
Perhaps the very first clothes our early ancestors had were animal skins. But the first skins used for clothing were not leather. They still had the hair on. Men did, however, learn how to make leather a very long time ago. The ancient Egyptians made such excellent leather that some of it has lasted to this day.

There are different ways of making an animal's skin into leather. One way is to rub oil into it. The American Indians made very good leather in this way. They sometimes smoked the skins after they had rubbed in the oil. Another way of making skins into leather is to soak them in some tanning liquid made from the bark or wood of certain trees. Tanning with alum or a compound of chromium is a third way.

There are many kinds of leather. The picture shows a few of the ways in which leather is used. No one kind of leather would be the best for all these purposes. The thick, stiff leather made for shoe soles, for instance, would not be good for a pair of gloves or a billfold.

Calfskin, kid, buckskin, suede, chamois, seal, morocco, lizard, patent leather, and alligator are some of the many kinds of leather we use. Most of these leathers get their names from the animals they come from. But morocco gets its name from the place where it was first made. And patent leather and suede get their names from the way the skins are treated after they are tanned. Suede is rubbed so that it looks like dull velvet. Patent leather is given several coats of varnish so that it will be very smooth and shiny.

There is now much imitation leather. Some of it is very hard to tell from real leather. (See ALLIGATORS AND CROCODILES; CATTLE; INDIANS, AMERICAN; LIZARDS; OAKS; OSTRICH; SNAKES.)



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LEAVES Many people cannot tell a white oak from a willow or a buckeye tree in the winter. But it is easy to tell these trees apart in the summer when they have their leaves. The leaves of a white oak look as if pieces had been cut out around the edges. We say they are lobed. A willow has narrow leaves with edges like little saws. A buckeye has leaves made up of several leaflets. Every tree has its own special kind of leaf. A tree's leaves serve as its name tags.

Trees are not the only plants that have leaves. Almost all bushes have leaves. Almost all vines have leaves. And many, many smaller plants have leaves. How strange our gardens would look if the vegetables and flowers in them were leafless.

As the pictures show, leaves are many different shapes. The veins of a leaf make a framework for it. They are much like a skeleton. Different kinds of leaves have their veins arranged in different ways. The shape of a leaf depends on the shape of its vein skeleton. Some leaves are so narrow that they are called needles.

In describing a leaf there are several questions to answer. Some of them have already been suggested. The questions are:

Is it a simple leaf or is it a compound leaf—one made up of leaflets?

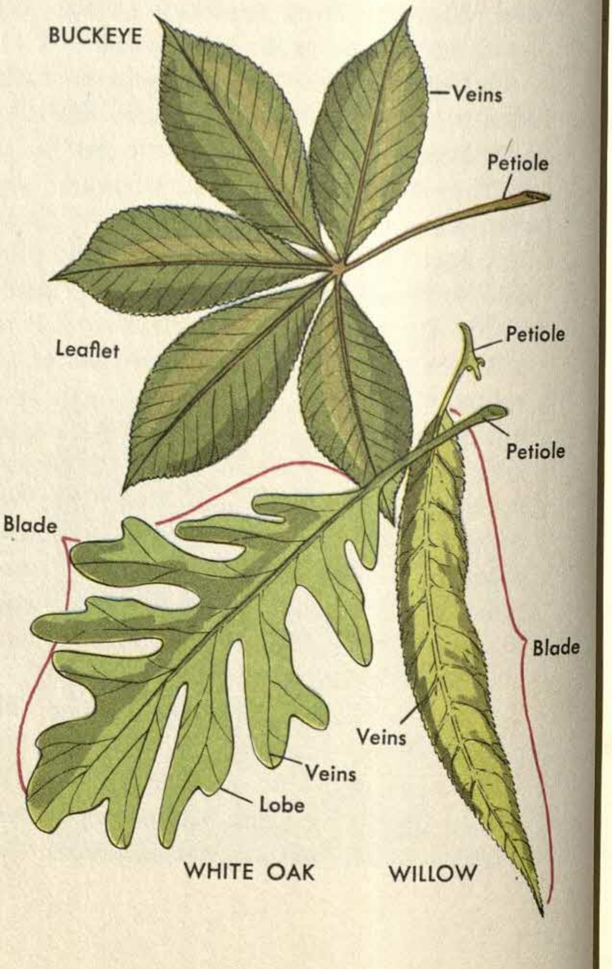
Is the edge smooth or is it like a saw?
How big is the leaf?
Does it have lobes?
What kind of pattern do its veins make?
Is the leaf thick or thin?
Is it waxy or rough?
Is there a leaf opposite it on the stem?

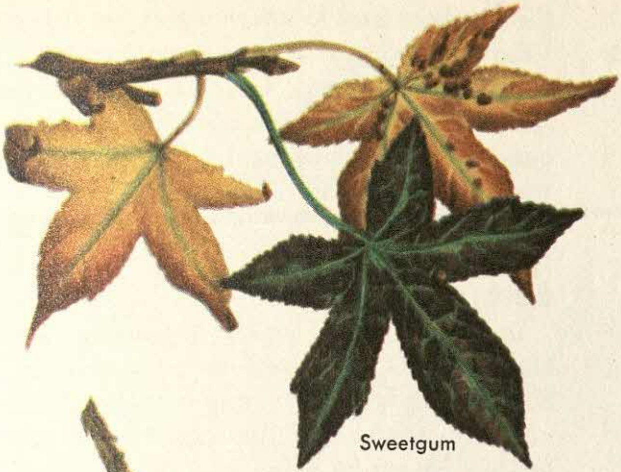
Leaves help make plants beautiful. But plants do not have leaves just to look pretty. A leaf is also a food factory. It makes food for the plant it is growing on.

Leaves make the plant's basic food—sugar—out of water and carbon dioxide. Green plants that live on land get their water from the ground as a rule, and their carbon dioxide from the air. The veins in a leaf are partly tiny water pipes. Carbon dioxide comes into a leaf through little pores. Some underwater plants have leaves. These leaves have no waterproof skin like that of other leaves. Carbon dioxide enters them dissolved in water. Leaves cannot make sugar out of carbon dioxide and water without light.

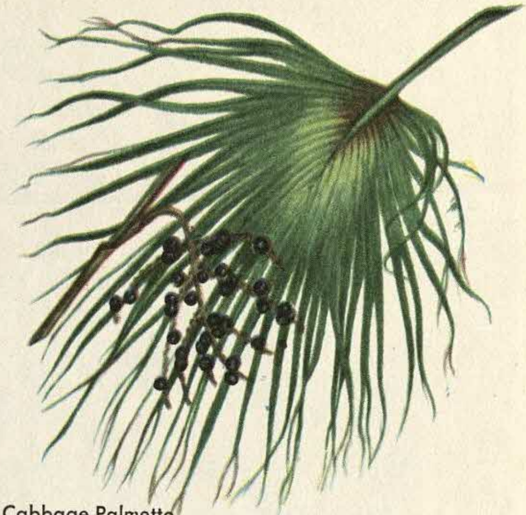
In order to make sugar, leaves must have in them the wonderful green coloring matter called chlorophyll. But not all leaves are green. Of course, a good many leaves change color in the fall. But some leaves are red all the time, some are yellow, and some are spotted. These leaves have their green dye hidden by other colors.

Leaves are food factories for the plants they grow on. They are food factories for us, too. For our food comes either from plants or from animals that eat plants. We get a little of our food from plants without leaves. But we would soon starve if all the plants with leaves should suddenly die. (See PLANT FACTORIES; TREES.)

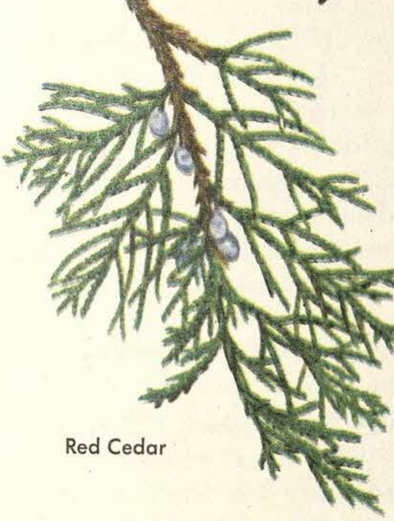




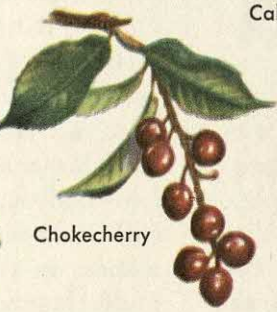
Sweetgum



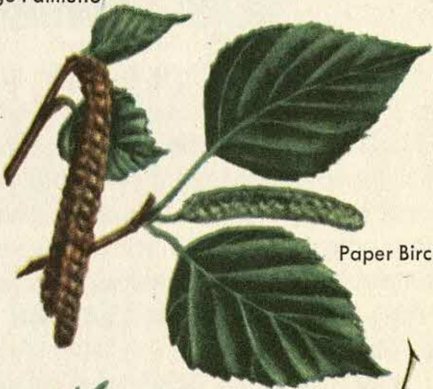
Cabbage Palmetto



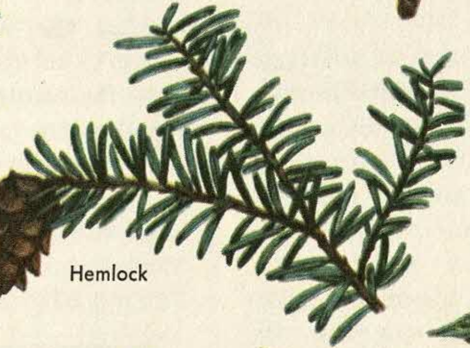
Red Cedar



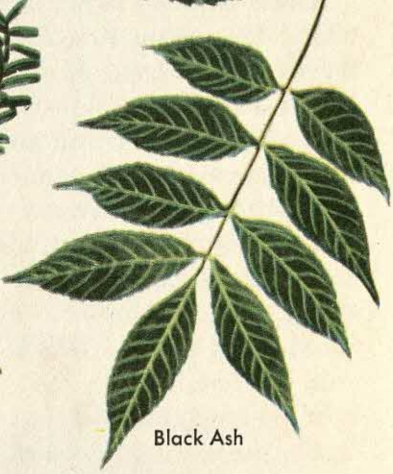
Chokecherry



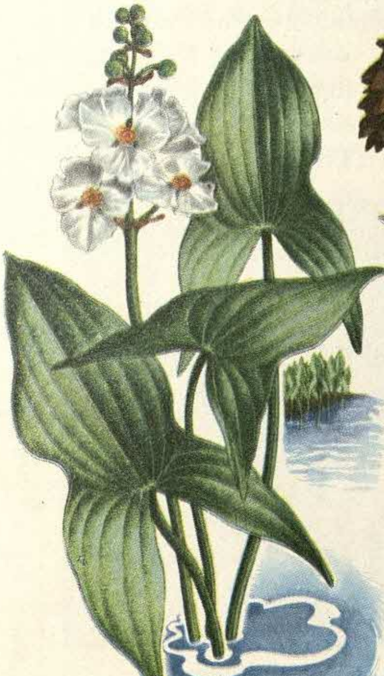
Paper Birch



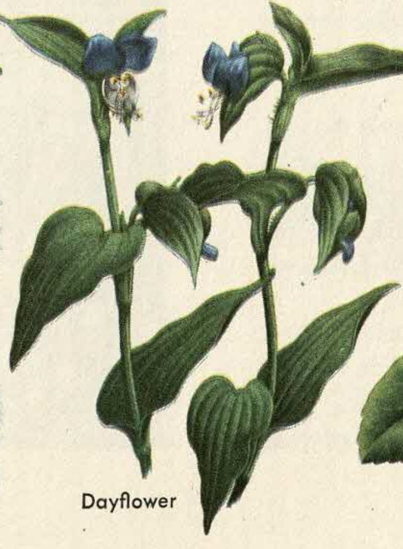
Hemlock



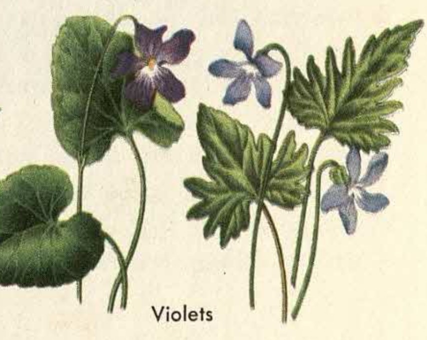
Black Ash



Arrowhead



Dayflower



Violets

Courtesy of John Hancock Mutual Insurance Company

LEE, ROBERT E. (1807–1870) Many famous Americans—George Washington and Thomas Jefferson among them—came from the state of Virginia. Robert E. Lee is another famous American of whom Virginia should be, and is, very proud. His fame is based on the military skill and leadership he showed in the Civil War, and on his fine character.

Robert E. Lee's father was "Light-Horse Harry" Lee, a famous soldier in the Revolutionary War. Robert spent his boyhood in Virginia. As soon as he was old enough, he entered West Point, the military academy where young men are trained to be officers in the United States Army.

He made an excellent record at West Point and became an army engineer. He won a name for himself as a soldier during the Mexican War. In 1852 he was made the head of West Point.

In the meantime Lee had married Mary Custis, the great-granddaughter of Martha Washington. She inherited a beautiful estate on the Potomac, the estate that has become the Arlington National Cemetery. The Lees made their home there.

After a few years as the head of West Point, Lee served as an army officer at different places in the West. When, after much rumbling, war broke out between the northern and southern states, President Lincoln asked Lee to be the commander of the Northern forces. Lee did not believe that the states should break apart into two nations. But he was loyal to Virginia, and Virginia was one of the southern states. Lee therefore told Lincoln that he could not lead the Northern armies. He resigned from the United States Army.

In 1861 he was placed in command of the Southern, or Confederate, army in Virginia. Before long he proved to be a military genius. He won some brilliant victories. But in 1863 he led his army into Pennsylvania. He was defeated at Gettysburg in one of the decisive battles of the war.

General Lee's troops retreated to Virginia. There he fought a losing war for almost two years. The Northern armies were much larger and were better supplied. When Lee finally surrendered in April, 1865, General Grant would not accept his sword. The soldiers in the Northern armies respected Lee for his courage and skill. His Confederate soldiers loved him.

After the war Lee wished the southerners to accept their defeat without bitterness. He wanted North and South to work together for a prosperous, united nation once more. He himself became the president of Washington College in Virginia. Its name was later changed in his honor to Washington and Lee University. (See CONFEDERATE STATES.)

Lee Surrendering to Grant

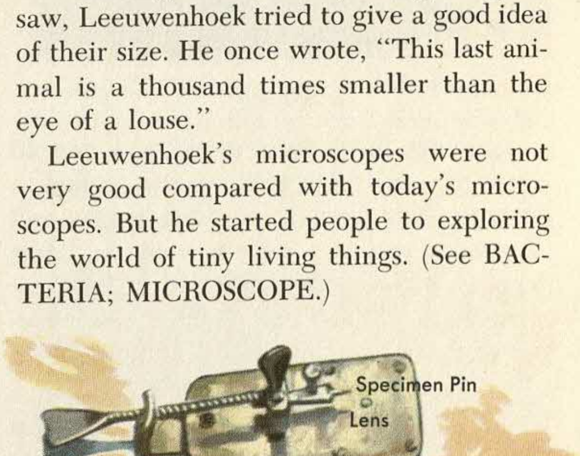
LEEUWENHOEK (LAY ven hoock), **ANTON VAN** (1632–1723) Many people think of Leeuwenhoek as the inventor of the microscope. He was not. But he built microscopes that were better than any earlier ones, and he was the first to see many of the tiny living things that are too small to be seen with our eyes alone.

Leeuwenhoek was Dutch. He was a dry-goods merchant in the city of Delft. He was also the janitor of the city hall there. But he spent much of his spare time building microscopes. In all he built 247. He liked to set up several microscopes at a time. Under one of them he might have a thread of wool, under another a bee's sting, and under a third a drop of wine. He kept a careful record of all that he saw.

Probably his biggest surprise came when he first looked through one of his microscopes at a drop of rainwater. He saw that it was full of tiny living things moving about. He called them "little beasties." He found "little beasties" also in scrapings from his teeth. We know now that most of the "little beasties" were the tiny organisms we call bacteria. Leeuwenhoek was probably the first person ever to see bacteria. He can be called the first "microbe hunter."

In writing about the tiny living things he saw, Leeuwenhoek tried to give a good idea of their size. He once wrote, "This last animal is a thousand times smaller than the eye of a louse."

Leeuwenhoek's microscopes were not very good compared with today's microscopes. But he started people to exploring the world of tiny living things. (See BACTERIA; MICROSCOPE.)



Leeuwenhoek's microscope had a lens between two thick sheets of silver riveted together. The specimen was placed on the end of a pin, and the microscope was then held up to a light.

LEGUMES The pea family is one of the largest of all families of plants. More than 12,000 plants belong to it. The plants in this enormous family are sometimes spoken of as legumes.

Some legumes are trees. The honey locust is one. Some, like clover, are small plants. Others, like the sweet pea, are vines. Some grow in deserts, some on mountain slopes, and some in moist lowlands.

Red Clover

Legumes have their seeds in a special kind of seedpod which is also called a legume. This special pod splits in two, and the seeds are in a neat row inside. Most legumes have leaves made up of three or more leaflets. And most of them have flowers shaped like sweet peas. At first glance a clover blossom does not seem much like a sweet pea. But a careful look shows that a clover blossom is made up of many tiny flowerets that are like sweet peas.

We raise many legumes in our fields and gardens. Alfalfa, clover, lespedeza, peas, beans, soybeans, peanuts, and sweet peas are among them. Some of our most nutritious foods come from legumes. Beans, for instance, are staple foods in many countries. A few wild legumes are poisonous.

Garden Pea

Some legumes help farmers in a very important way. They help make soil rich by adding nitrogen to it. On their roots are little bumps in which there are bacteria. These bacteria are able to take nitrogen from the air, something green plants cannot do. The bacteria help change the nitrogen so that green plants can use it. Planting a legume crop every few years and plowing it under is a practice many good farmers follow. (See BACTERIA; CROP ROTATION; FORAGE CROPS.)

Honey Locust

Ancient Viking Ship

LEIF THE LUCKY Columbus and his men were not the first Europeans to reach the Americas. Five hundred years before Columbus sailed to the New World, Norsemen had come and settled on the big island of Greenland and even on the mainland. One early Norse explorer was Leif Ericson, often called Leif the Lucky.

Leif's father was Norwegian-born Eric the Red of Iceland. Eric had left Iceland and founded a colony in Greenland in 986. That same year Bjarni Herjulfsson of Iceland, Norse sagas tell, set sail for Greenland and was blown off course. He finally found Greenland, but before he did he sighted land on to the south and west of the big island. Some years later young Leif heard Bjarni's story and set out to look for the land Bjarni told of seeing. He found it and named it Vinland. When Leif got back to Greenland he told others about it and urged them to go there to live.

Soon a band of settlers, with their livestock and household goods, set out for Vinland, following Leif's directions. They came first to a barren, treeless land they named Helluland (Land of Flat Stones). On down the coast after crossing what was probably Hudson Strait they came to a land of trees. They called it Markland (Forest Land). Farther on they came to Leif's Vinland. The little colony stayed in Vinland for three years. Then they gave up and went home. By the time Columbus rediscovered America the only people there were the Indians and Eskimos. (See EXPLORERS; VIKINGS; GREENLAND.)

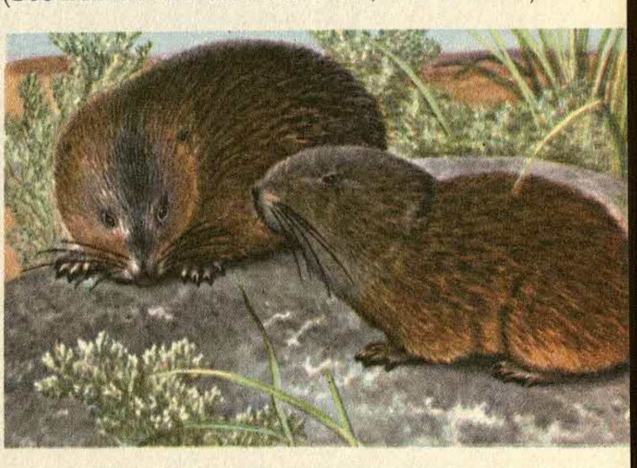
LEMMING The little animals called lemmings are rodents. They look a little like their relatives the rats. But unlike rats they do not have long tails. Lemmings are found in the far-northern regions of North America and Europe.

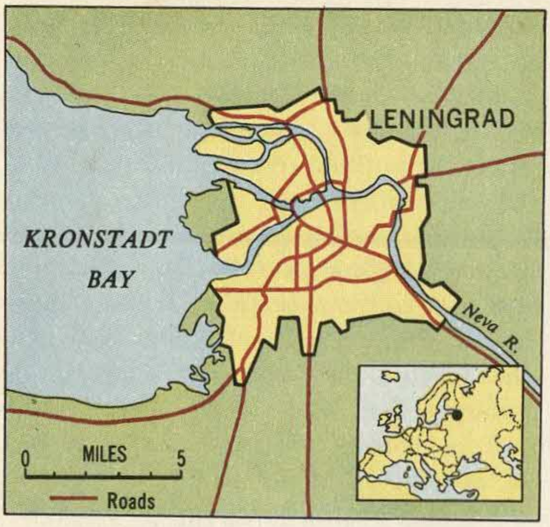
The lemmings in Norway and Sweden are famous for their travels. These lemmings live high in the mountains. They eat moss, lichens, and other small plants that grow there. When they have plenty to eat, they multiply fast. But their enemies—foxes, wolves, and bears—keep down the number of lemmings most of the time.

Now and then, however, there comes a year when they multiply so fast that their enemies do not keep the number of lemmings down. Soon the lemmings are too crowded. Armies of them begin traveling down from their mountain homes. They go through cities and villages and over farms and streams. They march in rows about three feet apart. They eat during the daytime, and travel on at night.

The lemmings finally come to the sea. In they plunge and are soon drowned. Of course, no one believes that they are trying to commit suicide. The lemmings do not know that the ocean is not like the streams they have been able to swim across.

Not all the lemmings go marching to the sea. Some stay behind and raise new families. Sooner or later there are again so many that another march to the sea begins. (See BALANCE IN NATURE; RODENTS.)





LENINGRAD When Peter the Great became the czar of Russia about 275 years ago, his country had no "window" on the Atlantic. Russia did not then touch the Baltic Sea or the Black Sea. It had the northern port of Archangel, which ships could reach by sailing into the Arctic Ocean. But for most of the countries of Europe the route to Archangel was a long way around. Peter the Great made up his mind to get a port on the Baltic.

As a first step Peter sent his armies against Sweden, the country that then owned the land between Russia and the Baltic. He won that land. Then Peter set about planning a port city. He decided to build it where the Neva River flows into the arm of the Baltic called the Gulf of Finland. He chose to build his new city on the low, swampy islands at the mouth of the river.

Building a city on the islands was a real task. But Peter knew just what could be done. Earlier he had gone to the Netherlands disguised as a ship's carpenter. There he had seen how the Dutch had saved their lowlands from the sea. To build Leningrad he called in engineers and skilled workmen from all over Europe.

Millions of huge piles were driven into the swampy land to make a firm foundation for the buildings. Soon a great fortress and a great cathedral rose high above the swamps. Other buildings were built fast. The city grew at an amazing rate. It spread over all the islands and onto the mainland. The swamps were gradually drained so that building was easier.

For many, many years Moscow had been the capital of Russia. Peter was so proud of his new city that he decided it should be the capital. He named it St. Petersburg. Beautiful government buildings and palaces were built.

One thing Peter could not do for his new city. He could not change the climate of the region. His window on the Atlantic was so far north that the water leading to it was frozen for about five months of every year. With the help of icebreakers, ships could reach the city for a part of those five months, but for the rest of the time the ice closed the port. Even so St. Petersburg was a very important port. Goods came pouring in from other lands. Russian goods poured out. Factories sprang up in the city, for the goods they made could easily be shipped away.

The city became famous for its beauty. The many bridges that joined the islands made it interesting. Besides the palaces of the czar there were many other beautiful homes. There were beautiful churches, too. It was not nearly so Russian a city as Moscow. Along with the goods from other countries came new ideas about art and architecture.

At the end of the rule of the czars, the capital was moved back to Moscow. St. Petersburg became Petrograd. Shortly after Russia became the U.S.S.R., the city's name was changed to Leningrad.

Even though it is no longer the capital and was badly damaged during a long siege in World War II, Leningrad is a large and important city. Over 3,500,000 people now live there. In the whole U.S.S.R. only Moscow is larger. Leningrad is the Soviet Union's greatest port and its largest manufacturing center. It can boast of one of the world's greatest art museums, the Hermitage. (See BALTIC SEA; U.S.S.R.)

LENS If you looked through a magnifying glass at these words, the letters would look bigger than they are. The lens of the magnifying glass would make them do so. A lens is a piece of glass or some other transparent material with at least one curved surface. Microscopes, telescopes, binoculars, and most eyeglasses have lenses.

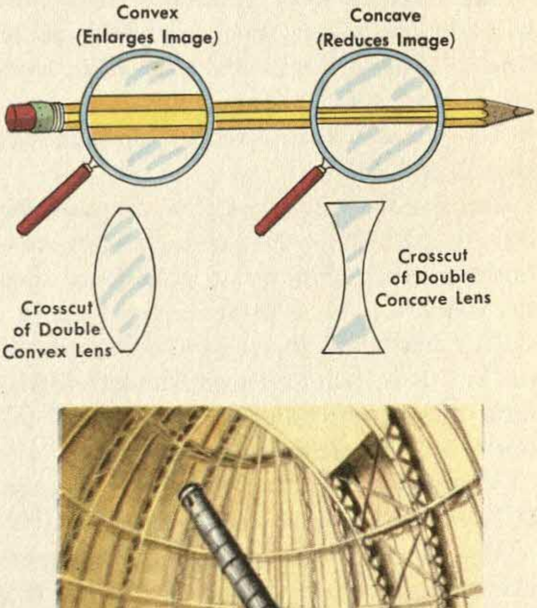
Some lenses we look through make things look smaller than they are. What a lens does depends on its shape. We use the words "convex" and "concave" in describing lenses. "Convex" means "bulging out at the center." "Concave" means "curving in toward the center." A lens may have one flat surface and one convex surface. A slice through the center would look like this: D. A lens may have one flat and one concave surface: [(. Both surfaces may be either convex or concave. Or one may be convex and the other concave.

Lenses bend light rays going through them. The rays bend toward the thickest part of a lens. The lenses that magnify when you look through them are convex or concave-convex. Those that make things smaller are concave or convex-concave.

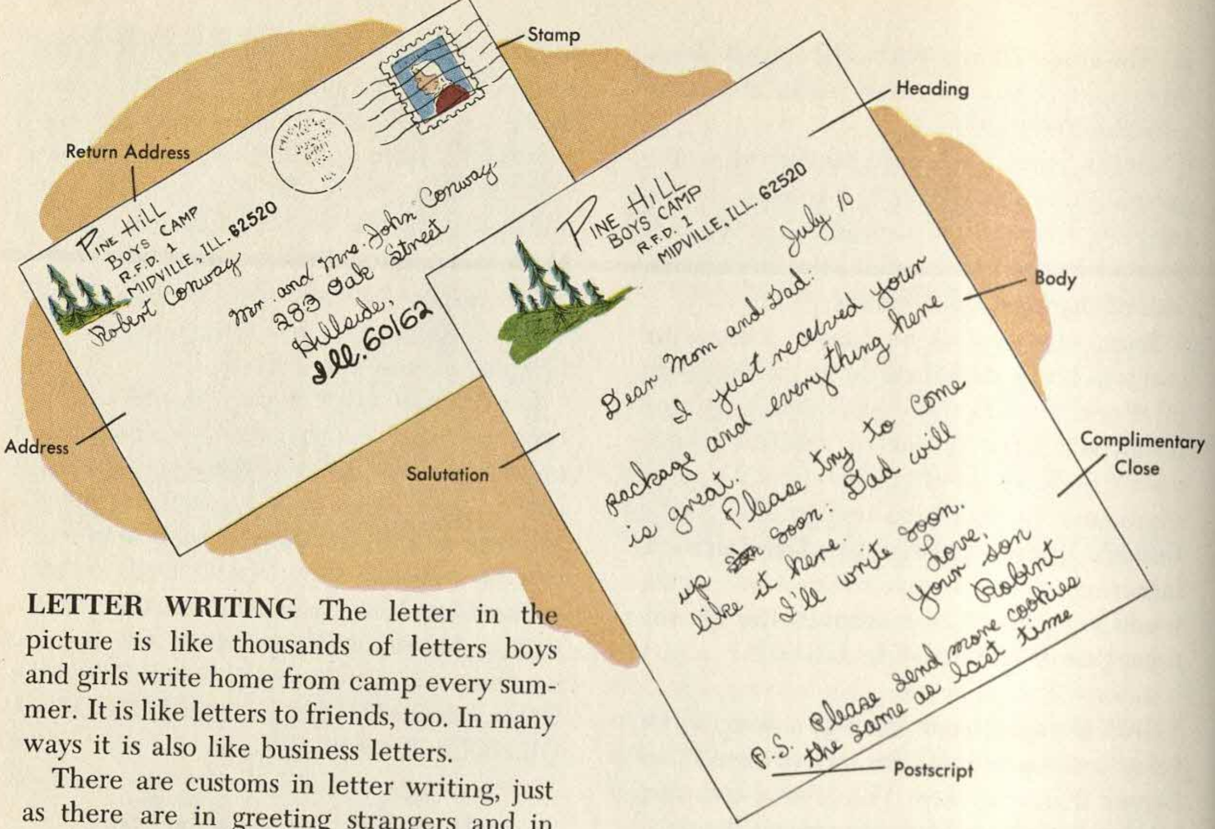
We do not always look through the lenses we use. Cameras and projectors have lenses. Camera lenses throw tiny pictures on the film in the camera. Projector lenses throw large pictures on a screen or wall.

Making lenses is a big industry. In the United States alone, for instance, tens of millions of eyeglasses are made each year. Many are simple lenses. Others are lens combinations. Not all of them are put in frames. Some are contact lenses—lenses that rest against the eyeball.

Good lenses are not easy to make. Fine cameras, microscopes, and telescopes are expensive chiefly because the lenses in them cost a great deal. The biggest lens in the world is in a telescope at Yerkes Observatory in Williams Bay, Wis. It is 40 inches across. This lens is a true giant compared with a microscope lens, which may measure only 1/16 of an inch. (See CAMERA; EYE; LIGHTHOUSE; MICROSCOPE; QUARTZ; TELESCOPE.)


Convex
(Enlarges Image)
Concave
(Reduces Image)
Crosscut of Double Convex Lens
Crosscut of Double Concave Lens

Telescope at Yerkes Observatory



PINE HILL
BOYS CAMP
R.F.D. 1
MIDVILLE, ILL. 62520
Robert Conway

Mr. and Mrs. John Conway
283 Oak Street
Hillside,
Ill. 60162

PINE HILL
BOYS CAMP
R.F.D. 1
MIDVILLE, ILL. 62520
July 10

Dear Mom and Dad:

I just received your package and everything here is great. Please try to come up ~~son~~ soon. Dad will like it here. I'll write soon.

Love,
Your son
Robert

P.S. Please send more cookies the same as last time

LETTER WRITING The letter in the picture is like thousands of letters boys and girls write home from camp every summer. It is like letters to friends, too. In many ways it is also like business letters.

There are customs in letter writing, just as there are in greeting strangers and in eating. These are customs followed in writing to one's family or friends:

The letter always has four parts. It may have a *postscript,* too.

The *heading* gives the date. It may also tell the address of the person who is writing the letter. Most printed stationery has the sender's address printed on it.

The *salutation* is a way of saying hello to the person who receives the letter. The most often used salutation is "Dear," followed by the person's name.

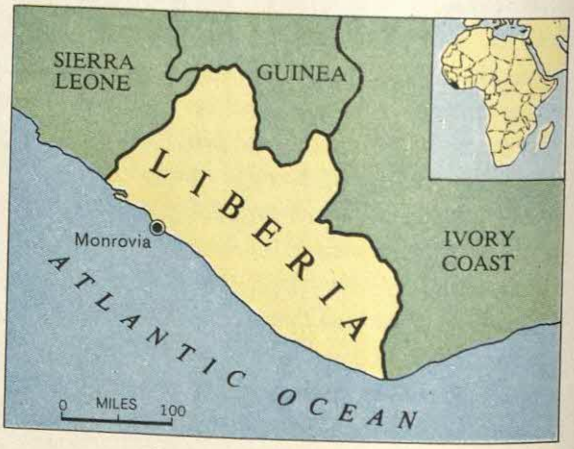
The *body* of the letter is the message. It should be pleasant and interesting.

The *complimentary close* is the goodbye of the letter. There are many forms that can be used. The close also contains the writer's signature.

The name and address of the person who is to get the letter should be put in the middle of the envelope. The name and address of the sender should be in the upper left corner of the envelope, and the stamp in the upper right corner. The ZIP code is an important part of an address.

LIBERIA About 150 years ago some American Negroes settled on the west coast of Africa. They were slaves who had been freed. These first settlers were really going back to their homeland, for their ancestors had come from Africa. Other freed slaves came to the colony. In 1847 it became the country of Liberia.

"Liberia" means "free." The name is a good one. Liberia, as you see, has been free for more than a century. It is far older than most free countries of Africa.



Liberia is close to the equator. It is very hot and rainy. Most of the country is covered with thick forests. But there is a coastal strip a few miles wide where most of the forest has been cleared away.

The country is about the size of Tennessee. More than a million people live there. About one in every 50 is a descendant of the first settlers. Many of the others are natives who live in the forests. They belong to several different tribes and speak different languages. For the most part they stay in the forests. They live in grass huts in small villages of their own.

The government of Liberia is much like the government of the United States. The head of it is a president. The country's capital, Monrovia, is a city of 80,000.

For years the country made slow progress. But recently the story has changed. There are now about 900 schools and 3,000 teachers. There are hospitals, too, and both a radio and a television station. An airport near Monrovia is large enough for big jet planes. New ports for shipping iron ore have been built and new railroads leading to them. There are more than 1,200 miles of state roads besides good roads on private plantations. In the great stretches of forest, however, most of the travel is still on foot along winding trails.

The natives of the forests raise manioc, bananas, okra, and tomatoes for themselves in small clearings. They gather palm nuts and wild rubber, too, and trade them for cloth and tools. Near the coast farmers raise many different crops, among them rice, sugarcane, peanuts, and coffee.

The cargoes Liberia ships to the rest of the world are mostly iron ore and rubber. Much of the rubber is raised on great plantations owned by two American rubber companies. Diamonds are becoming more and more important.

Many ships that come into the big ports of the world fly the Liberian flag. Most of these ships, however, are owned in other lands and are just registered in Liberia.

LIBERTY, STATUE OF One of the largest statues in the world stands on a little island in New York Harbor. The statue says "Welcome to America" to strangers who come to the United States. It says "Welcome home" to Americans coming back from other lands. The island the statue stands on was long called Bedloe's Island. But because of the statue its name has been changed to Liberty Island. The statue is the Statue of Liberty. Its whole name is "Liberty Enlightening the World."

The statue is copper with a framework of steel. It is hollow. But even so it weighs 225 tons. It is 151 feet tall. The head itself is as high as a two-story building. The index finger is 8 feet long. Its fingernail measures 13 inches by 10 inches. A strong light shines from the torch.

The people of France gave the Statue of Liberty to the people of the United States. They raised $250,000 to pay for it. They planned it to celebrate the 100th birthday of the United States.

The idea was agreed on in 1865. But work on the statue was not actually begun for several years. The artist who made it was Frédéric Auguste Bartholdi.

The statue arrived in New York in 1885. But the statue could not be put up at once. The base which the people of the United States had agreed to build was not ready. In fact, all the money needed for it had not yet been raised. But after the statue arrived, money for the base began pouring in. It came, mostly in pennies and nickels and dimes, from more than 100,000 people. The statue was unveiled on Oct. 28, 1886. The *New York Times* reported that "a hundred Fourths of July broke loose."

At first the flame of the torch was metal, like the rest of the statue. There were two rows of holes at the bottom of the flame. Plate glass covered them. Light from lamps inside shone out through the holes. But in 1916 the whole flame was made of glass. It took 600 one-foot squares. Many of the lamps in the flame are now electric lamps of the kind called mercury-vapor lamps. The torch is lighted from sunset to sunrise night in and night out.

Hundreds of thousands of people visit the Statue of Liberty every year. Some of the visitors climb up inside the statue all the way to a row of little windows in the crown.

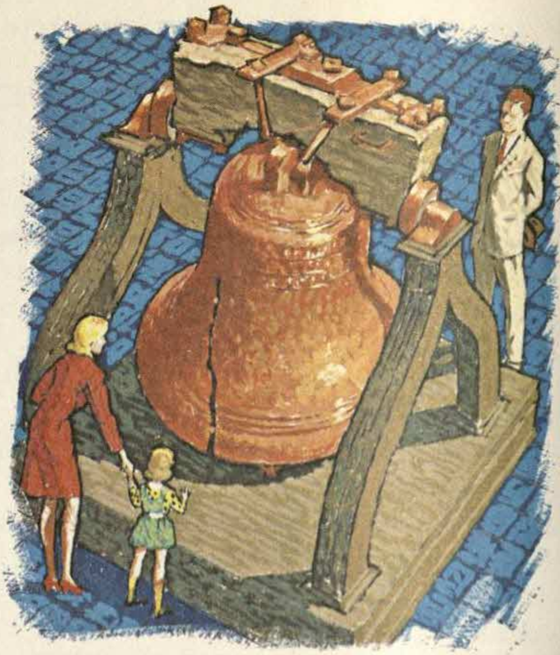
This statue means a great deal to the people of the United States. It reminds them that they are a free people.

LIBERTY BELL Every year a great many Americans visit the Old State House in Philadelphia. It is now called Independence Hall. One of the most interesting sights there is the Liberty Bell.

This bell was made in England. It was brought to Philadelphia in 1752, more than 20 years before there was a United States of America. The bell cracked at its first ringing and had to be melted down and recast. The recasting was done by Charles Stow and John Pass. They had to try twice before the bell was satisfactory.

In 1776 the American colonies decided that they wanted to be free from England. On July 4 the Declaration of Independence was read to the Congress in the State House in Philadelphia. The Congress voted in favor of it. Four days later the bell in the State House was rung to call the people of the city together to hear the Declaration.

For many years the bell was rung on every Fourth of July. It was rung at other special times, too. On July 8, 1835, it cracked when it was being tolled for the funeral of John Marshall, the chief justice of the Supreme Court.



The bell is made of bronze. It is three feet tall and weighs more than a ton. Around the top there is a verse from the Bible. It is: "Proclaim liberty throughout all the land unto all the inhabitants thereof." (See BELLS; BRONZE; DECLARATION OF INDEPENDENCE; FOURTH OF JULY; PHILADELPHIA.)

LIBRARY The Latin word for book is *liber.* The word library comes from it. Libraries are rooms or whole buildings in which there are collections of books. Some libraries are public. Anyone may go there to read the books. Others are private. Many of these belong to schools and colleges.

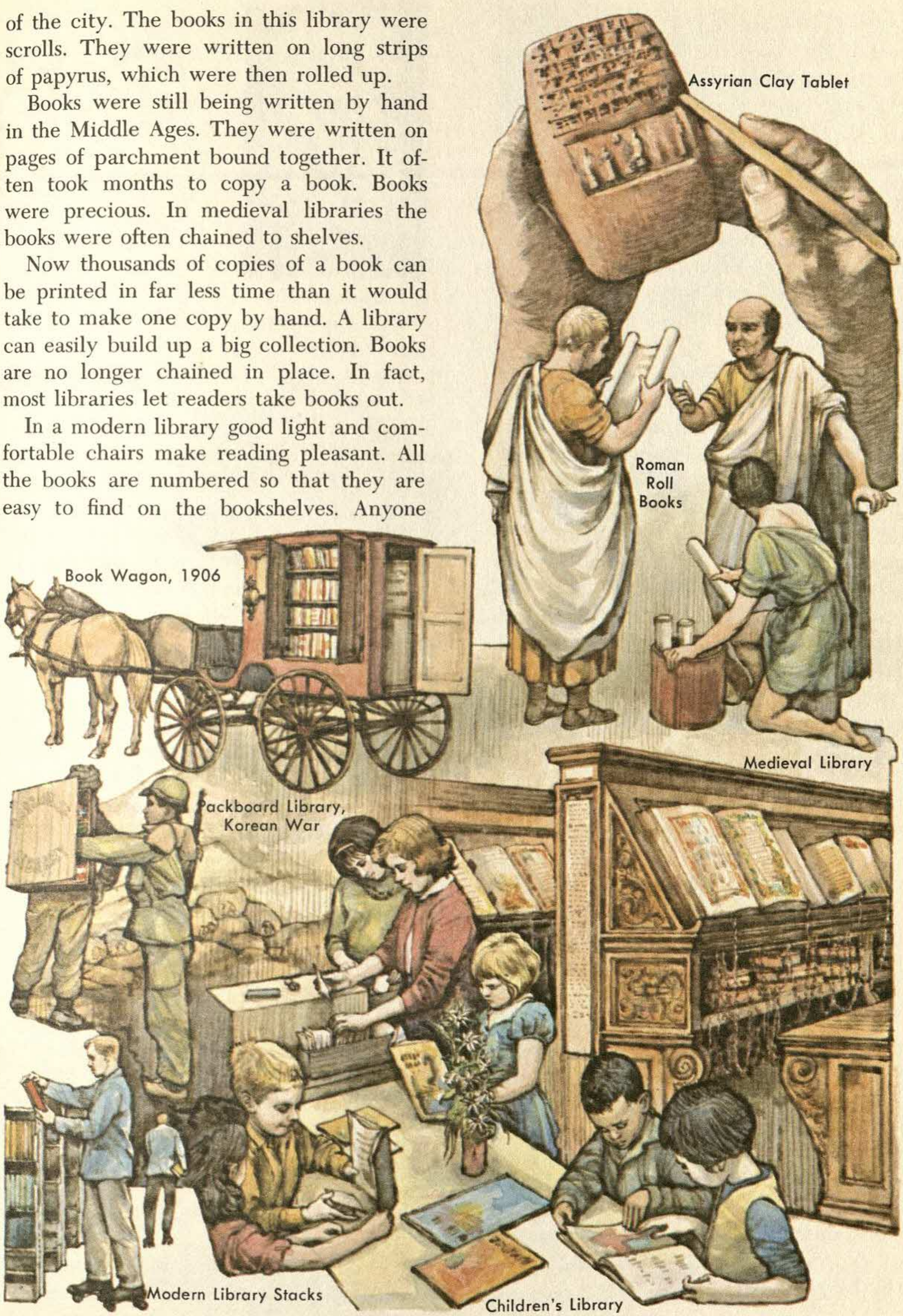
There have been libraries almost as long as there have been books. The oldest library we know about was in ancient Assyria. The 20,000 books in it did not look at all like ours. They were pillow-shaped tablets of clay. The writing was in cuneiform.

Another famous ancient library was in Alexandria, Egypt. It was begun in the time of Alexander the Great, the founder of the city. The books in this library were scrolls. They were written on long strips of papyrus, which were then rolled up.

Books were still being written by hand in the Middle Ages. They were written on pages of parchment bound together. It often took months to copy a book. Books were precious. In medieval libraries the books were often chained to shelves.

Now thousands of copies of a book can be printed in far less time than it would take to make one copy by hand. A library can easily build up a big collection. Books are no longer chained in place. In fact, most libraries let readers take books out.

In a modern library good light and comfortable chairs make reading pleasant. All the books are numbered so that they are easy to find on the bookshelves. Anyone



wanting a certain book can get its number from a file of index cards. Besides, there are trained librarians at hand to help.

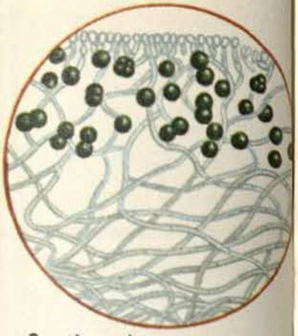
Almost every city in the United States has a public library. Some small towns have libraries, too. But many people in towns and in the country have no library near. Books may come to them by bookmobile—a branch library on wheels. Bookmobiles follow schedules as they travel about. At each stop books are signed out and those loaned out the time before are gathered up.

But libraries do much more than lend books. Many hold discussions and book talks, both live and on the air, have concerts and exhibits, and show special films.

To carry on all they do, big libraries more and more are using such up-to-date devices as computers and photocopiers. Computers can catalog, or list, books and papers, sort them by subject, and give answers as to where to find needed information. They can sign out and check in books. Photocopiers let libraries have copies, either full size or on a microscale for easy storage, of books and other written material impossible to get any other way. With photocopiers libraries often can fill requests for loans from other libraries easily by sending copies instead of original works.

One of the largest and most famous libraries in the world is the Library of Congress in Washington, D.C. This library has already outgrown two big buildings and is getting a third. The present two cover 13 acres. There are 250 miles of shelves. The library has more than 12,500,000 books and pamphlets and even more millions of manuscripts. In addition there are millions of maps and pictures and pieces of music. There are thousands of phonograph records, motion pictures, tape recordings, and bound volumes of periodicals. Of the famous documents in this great library, the most famous is the Declaration of Independence. (See BOOKS AND BOOKBINDING; COPYRIGHT; MICROFILM.)

Speckled Lichen


Section through a Lichen Showing Green Algae an Fungus Threads

Scale Lichen

Old Man's Beard

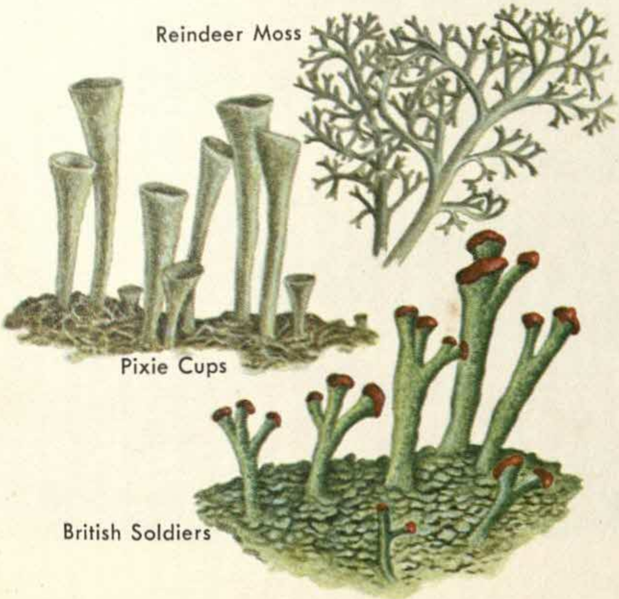
LICHENS In the world of plants there are many partnerships. But no other plant partnership is closer than the one in lichens. Lichens are two-in-one plants. Each lichen is made up of many tiny green algae and a mass of fungus threads. A fungus is not green and cannot make food for itself as green plants do. The algae in a lichen make food for themselves and the fungus. The fungus threads hold the algae in place and soak up water from fog, rain, and dew for themselves and the algae.

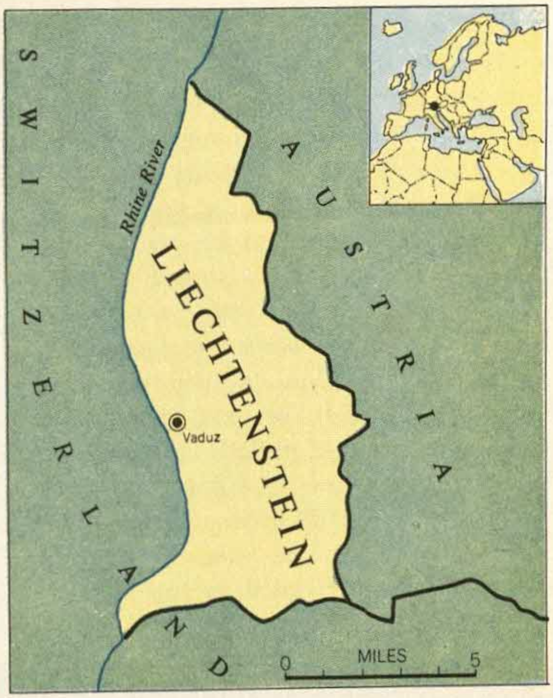
Lichens live in places where other plants cannot grow. They often, for instance, live on bare rock. The fungus of a lichen growing on a rock gives off an acid that eats its way down into the rock. In this way it fastens itself and its partners tight to the rock. Little by little, lichens make the rock crumble into soil. In time there is enough soil for other plants. Because lichens pave the way for other plants, they are called plant pioneers.

There are different kinds of lichens, about 6,000 in all. Some look like a thin crust on the rock or log on which they are growing. Some look like flat clusters of small leaves. Others have stalks. Most lichens are small, but some are fairly large. Reindeer moss, which is really not a moss but a lichen, grows to be several inches tall and rather bushy. Old man's beard hangs down from trees in long streamers. Many lichens are grayish green. But a lichen may be white, brown, orange, yellow, or almost black. The little lichens called British soldiers get their name from their bright red "caps."

Lichens have no flowers. Neither algae nor fungi are flowering plants. Some new lichen plants start from bits of a lichen that are broken off and blown to a new place. Some start from small buds no larger than grains of sand. A bud is a tiny ball of fungus threads around a few algae. Insects often carry these buds to new homes.

Lichens are a help not only because they are plant pioneers but also because they furnish food for reindeer and other animals. The Lapps gather and dry lichens as fodder for their reindeer. Desert dwellers sometimes eat lichens mixed with other foods. The manna from heaven the Bible tells about may have been bits of lichen blown down from mountaintops and piled up in the valleys. Litmus, a dye used in chemistry, comes from a lichen. (See ALGAE; FUNGI; PLANT KINGDOM.)





LIECHTENSTEIN The tiny European country of Liechtenstein is tucked in between Austria and Switzerland. Only three countries in the world are smaller—San Marino, Monaco, and Vatican City. Rhode Island, the smallest state in the United States, is nearly 20 times as big as Liechtenstein. Vaduz, the capital, is a town of about 4,000. It is known for the beautiful postage stamps its people engrave.

In the whole country there are about 20,000 people. Some of them earn a living by raising cattle, sheep, and goats. There are excellent mountain pastures. But far more of the people work in factories. The factories produce, among other things, textiles, pottery, drugs, and fine tools.

Liechtenstein's ruler is a prince. He lives in an ancient castle high on a bluff overlooking Vaduz. The country has no army. It does have about 50 police officers.

Switzerland is Liechtenstein's best friend among the nations of Europe. Switzerland manages the little country's postal and telegraph systems and its foreign affairs. The people of Liechtenstein use Swiss money. Like many of the Swiss, they speak German.

LIFE THROUGH THE AGES The chart on these two pages and the next two tells about life on the earth for the past 600 million years. There were living things even earlier than 600 million years ago—probably more than a billion years earlier —but no one knows much about them. They did not leave many traces, or fossils, behind them. Countless fossils were necessary to build up the story the chart tells.

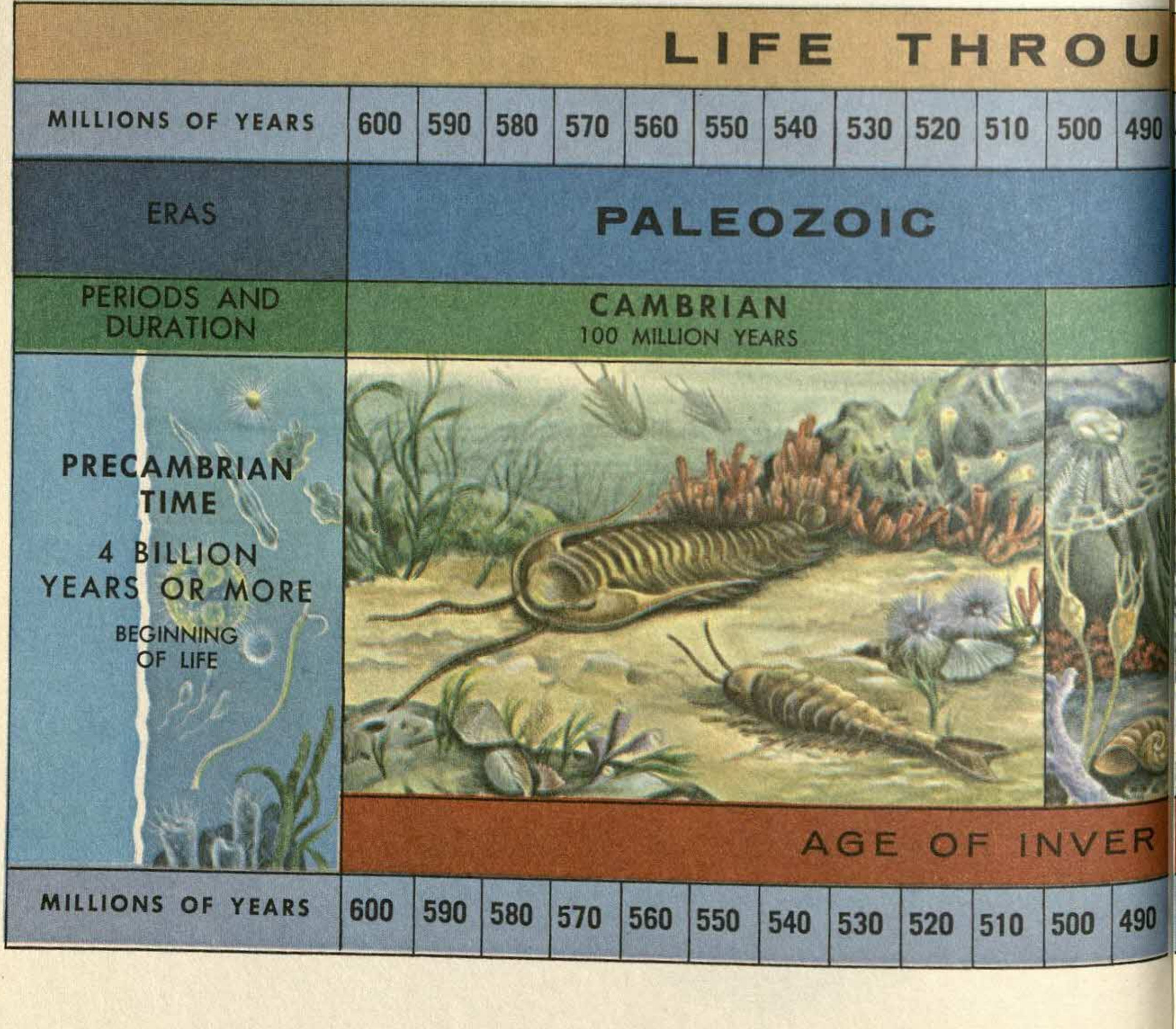
From the chart you can see how scientists have divided the past 600 million years into eras and periods. It gives, too, the common names for different stretches of time in the earth's history.

Six hundred million years ago all the plants and animals lived in the sea. The land was bare rock.

None of the animals living then had backbones. The time was the beginning of the long period commonly called the Age of Invertebrates. The word "invertebrates" means "animals without backbones."

The largest animals were the trilobites. They were jointed-legged animals, but they were not closely related to any of the vast group of jointed-legged animals of today. The trilobites had many neighbors. There were lamp shells and sponges and jellyfish. There were snails and worms. Probably there were enormous numbers of tiny one-celled animals, too. Along the shores grew seaweeds, the chief plants of the time.

As millions of years went by, other animals without backbones appeared in the sea. There were corals, starfish, and clams.



There were sea lilies and sea scorpions. Head-footed animals appeared, too—the ancestors of our squids.

The Age of Invertebrates lasted for about 200 million years. At the end of this long time most life was still in the sea.

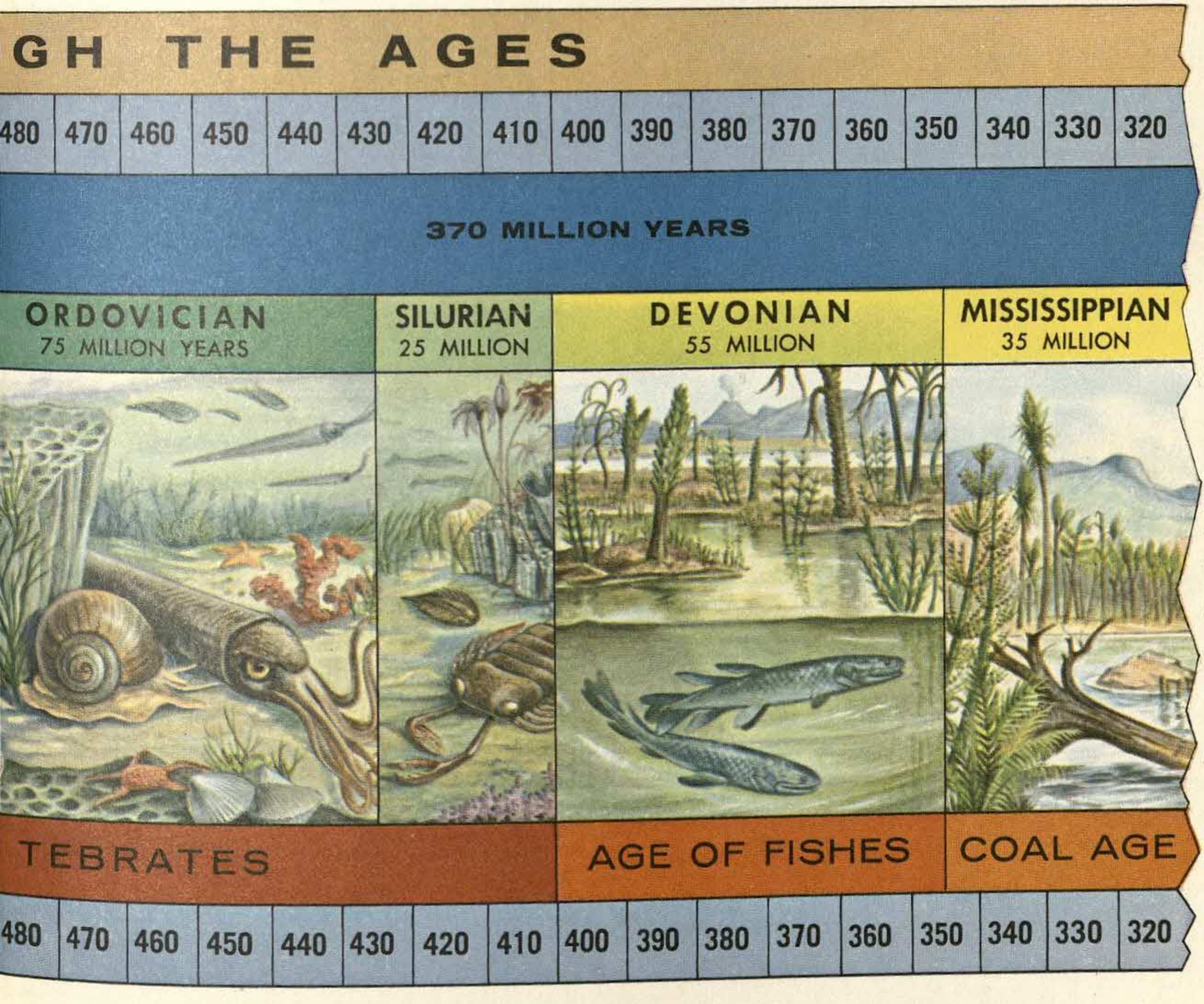
There were, however, some small plants and animals on land. The first land animal may have been a scorpion. Millipedes appeared early, too. Among the first plants to succeed on land were some much like the little liverworts of today.

As life was spreading to the land, fishes, the first animals with backbones, appeared in the sea. They were very successful. There came to be so many that the 55 million years after the Age of Invertebrates is often called the Age of Fishes.

During the Age of Fishes a second group of backboned animals appeared—the amphibians. These new animals were ancient relatives of our toads and frogs. They spent part of the time on land. An important new group of land animals without backbones had its beginning, too—the insects. New and bigger land plants also appeared.

During the next 65 million years much of the land was covered with swamp forest. Most of the trees were very different from any we have now. They were giant ferns and club mosses and horsetails. This time is often called the Coal Age, for many of the forests were buried and later became layers of coal.

During the Coal Age big amphibians sunned themselves on the edges of swamps.



Continued on page 804

Dragonflies far larger than any insects of today flew among the trees. Cockroaches four inches long scuttled about.

By the end of the Coal Age there was a third great group of backboned animals—the reptiles. For some 200 million years the reptiles were the lords of the earth. The time is called the Age of Reptiles.

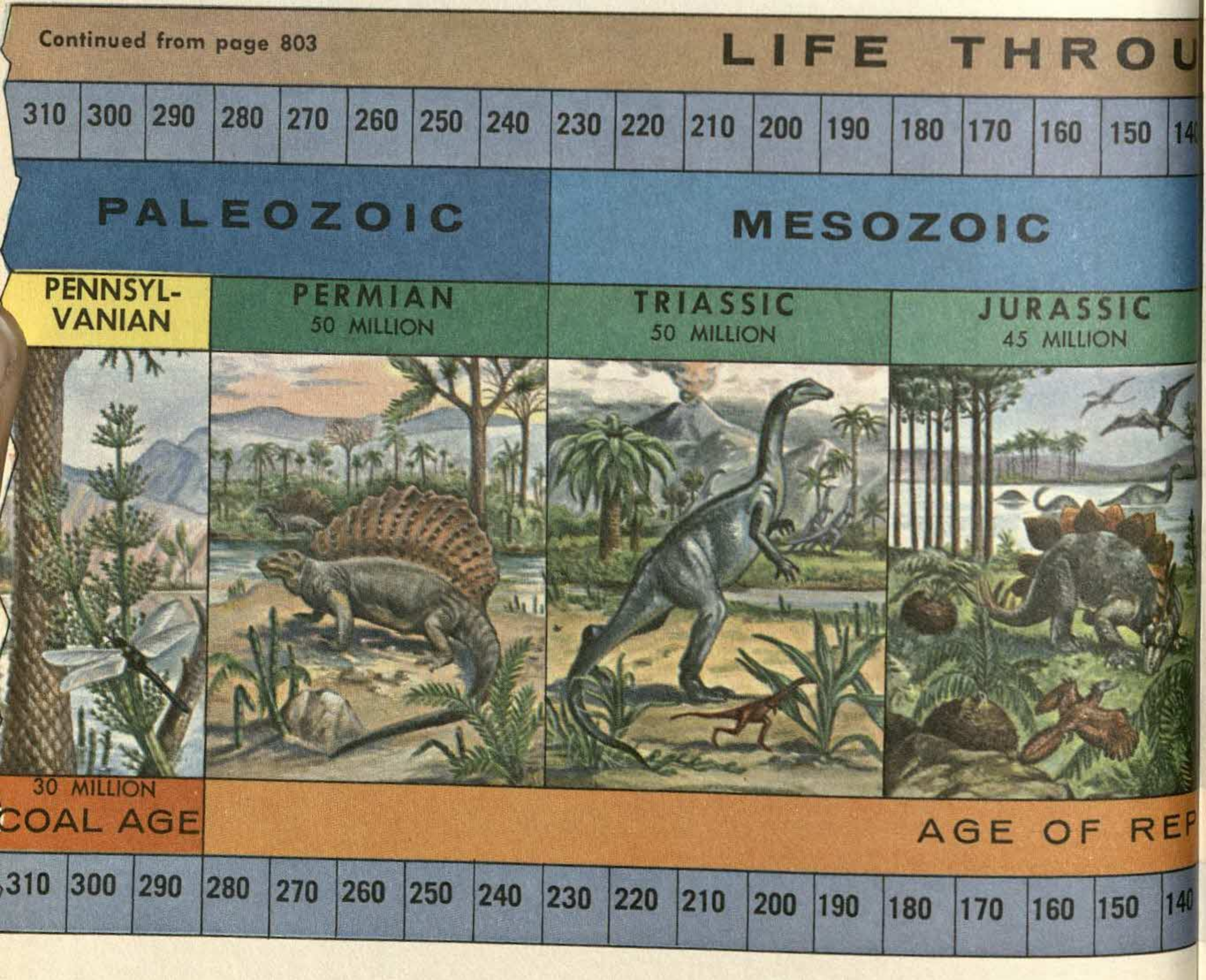
During this long age, thousands of kinds of reptiles called dinosaurs appeared. Many were huge, but some were no bigger than a chicken. There were both plant eaters and meat eaters. Some walked on two feet, some on all fours.

Not all the reptiles were on the ground. There were flying reptiles called pterosaurs. The name comes from two Greek words meaning "wing" and "reptile."

Many reptiles, moreover, lived in the sea. There were sea lizards, ichthyosaurs, and plesiosaurs. There were turtles and crocodiles, too. These reptiles, however, did not crowd out the fishes.

During the long Age of Reptiles the earliest birds appeared. So did the first mammals. There were also important new plants—conifers and plants with flowers.

The Age of Reptiles ended about 65 million years ago, and the Age of Mammals began. At that time the dinosaurs died out. So did the ichthyosaurs, the plesiosaurs, and the flying reptiles. But some reptiles lived on. There are still turtles and crocodiles. And there are still large numbers of lizards and snakes, reptiles that appeared late in the days of the dinosaurs.



At first all the mammals were land animals, but in time some mammals moved to the water. Among them were the whales, the seals, and the otters.

In the early part of the Age of Mammals the land mammals were small. Later some true giants appeared. The largest of them was a giant rhinoceros, *Baluchitherium.* It was the biggest land mammal of all time, standing 18 feet high at the shoulder.

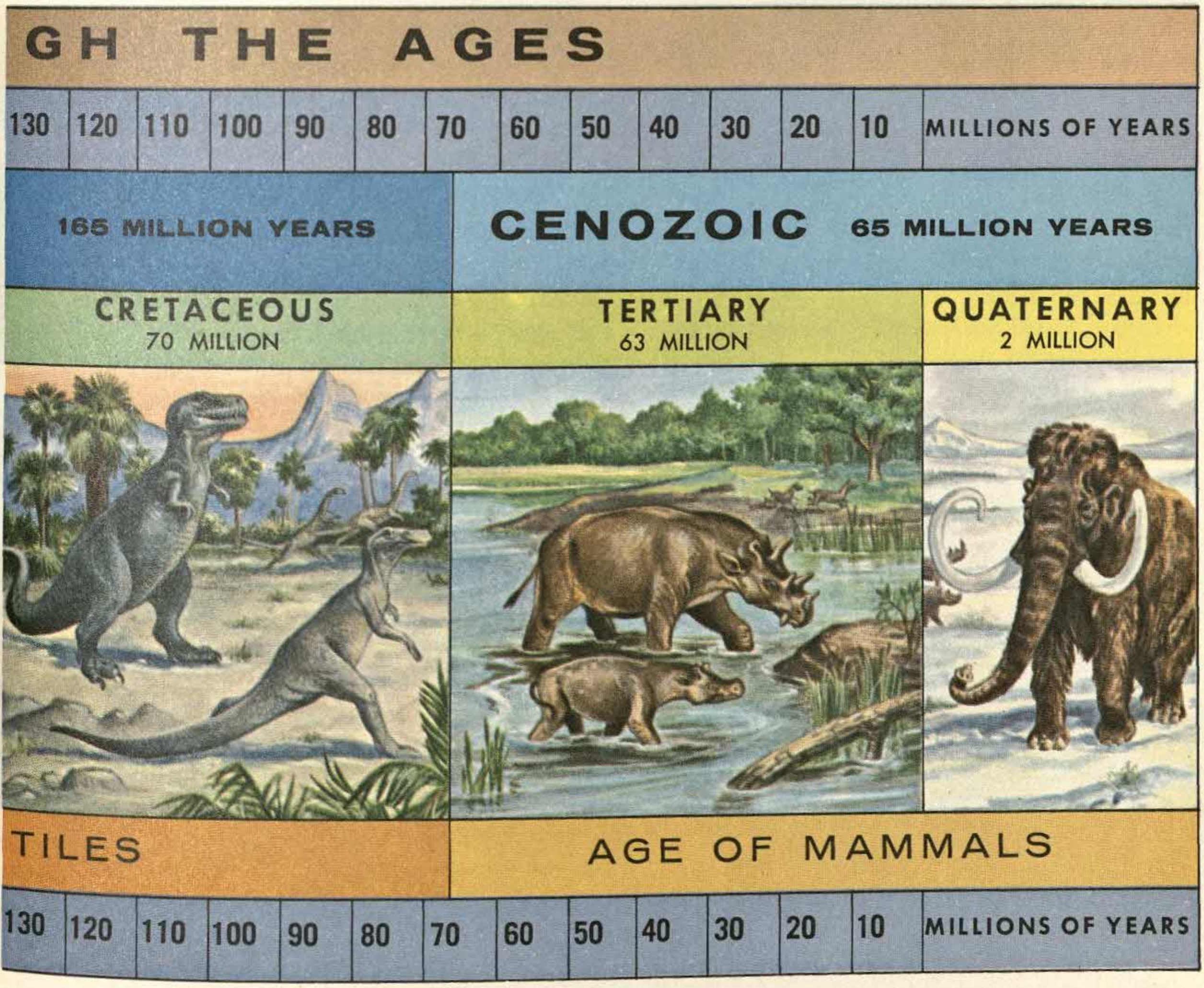
Many of the mammals of long ago disappeared completely. There are no descendants today. But the ancestry of some of today's mammals—the horse, for example—can be traced back for millions of years.

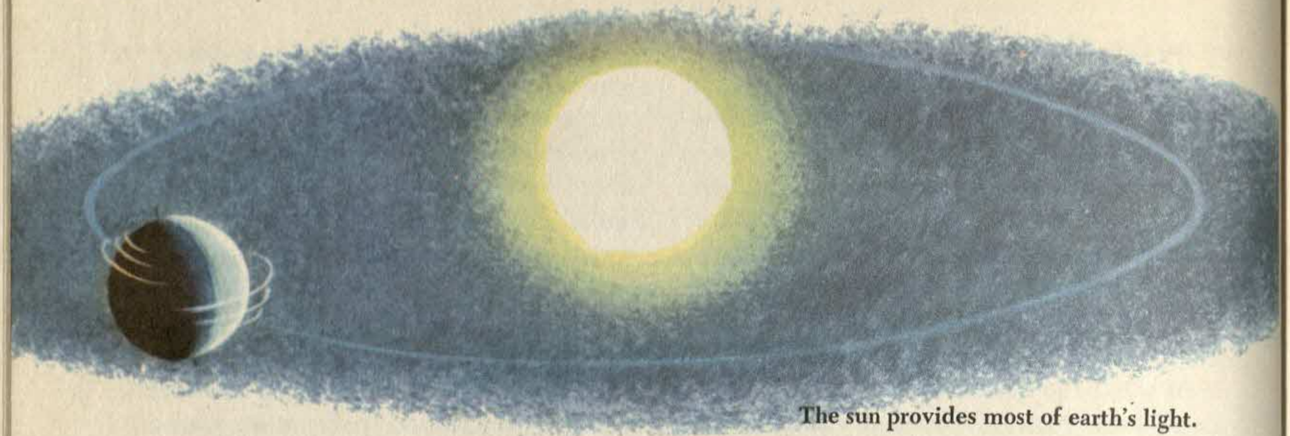
There came to be giants among birds, just as there were among mammals. Most of the giant birds are gone.

About two million years ago the time we call the Ice Age began. This period is counted as a part of the Age of Mammals. Both the birds and the mammals were well fitted for living through a time of ice and cold. For they are all warm-blooded. At some time during the Ice Age—no one knows exactly when—man appeared.

The Age of Mammals—the age we are still in—might well be called the Age of Flowering Plants. For during it flowering plants have spread over the land and crowded aside most other plants.

Will the Age of Mammals last on and on? Or, far from now, will some other animals push the mammals aside? No one knows. Today, at least, the mammals are holding their own. (See EARTH HISTORY.)



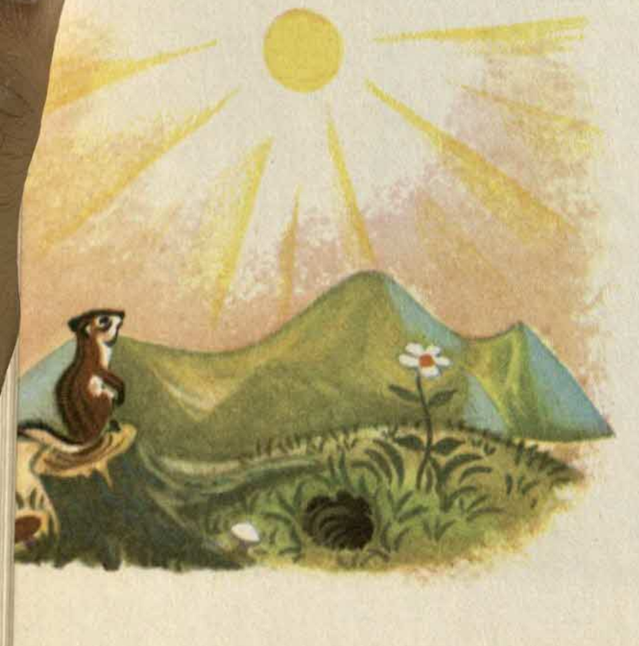


The sun provides most of earth's light.

LIGHT If there were no light we could not see anything at all. Light must come to our eyes from whatever we see—a star, a cloud, a dog, or anything else. The light may be given off by what we are seeing. We see stars and neon signs and fireflies because they give off light of their own. We see the moon and sidewalks and grasshoppers because some of the light that reaches them from the sun or lamps or bonfires bounces into our eyes.

Things that give off their own light we call luminous. Things that can be seen only when light shines on them we call nonluminous. We see nonluminous objects by reflected light.

Light travels very fast—almost unbelievably fast. Its speed is roughly 186,000 miles a second! In a single second it can travel as far as 7½ times around the earth at the equator. But no beam of light ever curved round and round the earth. Light as a rule travels in straight lines. Often we hear someone talking around a corner when we cannot see him. Light does not bend around corners as sound does.



We can see candy wrapped in cellophane almost as clearly as if it had no wrapping on it at all. Light can travel through cellophane. Another way of saying the same thing is that cellophane is transparent.

Light travels through waxed paper. But the light that comes through it is scattered so that we cannot see clearly what is on the other side. Such substances are called translucent. Some substances let no light come through them unless they are in very thin sheets. They, we say, are opaque.

People in America cannot see the people in China. One reason is that light cannot curve around the earth or travel through the earth. Even if the earth were not curved, no one could see China from America. There are too many things on the earth's surface to interfere with the traveling of light—too many things that are not transparent. Smoke, fog, buildings, and mountains are a few of them.

Many people, if asked why China cannot be seen from America, would say, "It is too far away." But this answer alone is not a good one, for we see some things that are much, much farther away than China. The moon is 40 times as far away as China is from San Francisco. The sun is 16,000 times as far away. The Dog Star is 8 billion times as far away. And most stars are very much farther away than the Dog Star. Of course, we cannot see the sun, moon, and stars if clouds are in the way. But through most of the distance from the heavenly bodies to the earth there is nothing to interfere with light.

In every thunderstorm we are reminded that light travels very fast. For we see a flash of lightning before we hear the thunder caused by the flash. The light from the lightning reaches us in almost no time at all. It may take several seconds for the sound of the thunder to reach us.

Light travels in straight lines as a rule. But we have invented ways of bending rays of light. We have invented mirrors and prisms and lenses. They all bend rays of light. We have learned to use them to make things look larger or nearer. We have learned to use them to get perfect reflections. We have built microscopes, telescopes, periscopes, opera glasses, eyeglasses, and binoculars. Our eyes are wonderful, but with the help of these inventions we are able to see many things that we cannot see with our eyes alone.

People used to have to depend on the sun, moon, and open fires for light for seeing. Now there are many kinds of lamps.

Lenses bend light passing through them.

Mirrors reflect light so well that we can see our reflections in them.

Light is important because it lets us see. But it is important for other reasons, too. Light from the sun helps warm the earth. Besides, light makes it possible for green plants to make their own food. If green plants could not make food, we could not live. Neither could any other animals. Except for salt, all the food we and other animals eat can be traced back to green plants. A world without light would be a dead world. (See CAMERA; COLOR; EYE; LAMPS AND LIGHTING; LASER; LENS; MICROSCOPE; MIRROR; TELESCOPE.)

Luminous, or Light-giving

Nonluminous, or Light-reflecting

Lighthouse on Rocky Shore

LIGHTHOUSE Ships far out at sea run into few dangers. A bad storm may make a trip rough, and once in a while an iceberg gets in the way. But the dangers are not as great as near shore. The story of ships and sailing tells of many shipwrecks on rocky coasts or on sandbars. For many hundreds of years men have built lighthouses to help prevent such shipwrecks. One of the Seven Wonders of the Ancient World was a lighthouse—the Pharos in the Bay of Alexandria. It was a great tower of stone on which a bonfire was kept burning.

In time candles and oil lamps took the place of bonfires. Then came acetylene gas lamps and electric lamps. The best lighthouses of today have electric lamps with lenses and giant reflectors. Some of their lights can be seen for more than 20 miles. The strongest lighthouse light in the United States is at Charlestown, S.C. This light is as strong as 28 million candles.

In the days of candles and oil lamps, a lighthouse light had to be watched constantly. Since lighthouses are usually on rocky islands or on points of land reaching out into the sea, a keeper often led a lonely life. Now the lights need much less watching. In fact, some modern lighthouses need no keeper at all. They are automatic. The lights are turned on and off by time switches or by devices worked by light from the sun. Even in thick fogs when their lights cannot be seen, lighthouses have ways of guiding ships. Then foghorns are sounded. Many lighthouses send out radio signals, either continuously or at intervals, whatever the weather.

Lights are needed in some places where it is not possible to build regular lighthouses. In such places there may be lighted bell buoys, lightships, or offshore towers. Offshore towers began replacing lightships in the 1960's. All but 5 of the 12 United States lightships now on duty are to be replaced. Those to stay on are the "Nantucket" off Massachusetts, the "San Francisco" and "Blunts Reef" off California, the "Umatilla" off Washington, and the "Columbia" at the mouth of the Columbia River. (See SEVEN WONDERS OF THE WORLD.)

LIGHTNING A flash of lightning is a big spark of electricity. It may go from one cloud to another or from one part to another of the same cloud. In these cases it does no harm. It may jump from a cloud to the ground. Then it may do a great deal of harm. Lightning may strike a house or a barn and set it on fire. It may kill trees, horses, cattle, and even people.

The common kind of lightning is usually called either forked or chain lightning. On summer evenings low in the sky there is often heat lightning. This is really just the glow from distant lightning below the horizon. Ball lightning is a different kind of lightning. It looks like a ball of fire rolling along. The ball finally explodes and disappears. It does no harm. Most people have never seen ball lightning.

Lightning causes thunder. Many children are afraid of thunder. It is very foolish to be. Thunder is not dangerous. If a person hears the thunder after a flash of lightning, he may be sure that he is safe from that lightning. For thunder always comes after the lightning has flashed.

How long it is between the lightning and the thunder depends on how far away the lightning is. Light travels very fast—186,000 miles a second. The light from a

Forked Lightning

flash of lightning reaches us in almost no time at all. Sound travels much more slowly. It takes sound about 5 seconds to travel a mile. If the thunder comes 5 seconds after the lightning, the flash was a mile away. If it comes 10 seconds after, the flash was 2 miles away.

The people of long ago made up many stories to explain lightning. In most of these stories lightning was the flash made when an angry god hurled some kind of weapon down to the earth. Thunder was the noise made when the weapon struck.

It was Benjamin Franklin who showed that lightning is a huge spark of electricity. We know now that the tiny drops of water in a cloud become charged with electricity as they move through the air. When the charge or charges become great enough, a spark jumps from one charged part to another or to the ground. As it goes through the air, it heats the air. The air expands and rushes outward just as violently as if there had been an explosion. This rushing outward causes the sound waves we hear as thunder.

Scientists have instruments that help them find better ways of protecting people and buildings from lightning. One good rule for protecting ourselves is this: In a thunderstorm do not stand under a tree or near a tall pole of any kind. (See CLOUDS; ELECTRICITY; FRANKLIN; MYTHS AND LEGENDS; STORMS.)

LIGHTNING BUG The bulb of an electric lamp gets hot when lighted. Lighted candles, oil lamps, and gas lamps give off heat, too. But some insects give off light without giving off enough heat to feel. The lightning bug is one of these insects with the secret of "cold" light. The lightning bug gets its name because its light flashes on and off. It is also called a firefly.

Lightning bugs are neither bugs nor flies. They are beetles. Their light comes from a special organ on their abdomens. Chemicals join with oxygen to make the light. A lightning bug's light helps it find a mate.

The light from several lightning bugs is bright enough to read by. But of course it is not steady. The Chinese and Japanese put lightning bugs in tiny cages and hang them in their houses and gardens for decoration. In the tropics there are big lightning bugs. The ancient Aztec Indians of Mexico used to carry cages of them for lanterns on night journeys.

Frogs eat lightning bugs. In fact, a frog may swallow so many that it glows!

Lightning bugs have four stages in their life histories: egg, larva, pupa, and adult. The larvas and pupas of these beetles live in the ground or hidden under logs or bark till they grow up. It may take two years for a lightning bug to become an adult. (See BEETLES; LAMPS AND LIGHTING.)

Lincoln's Birthplace

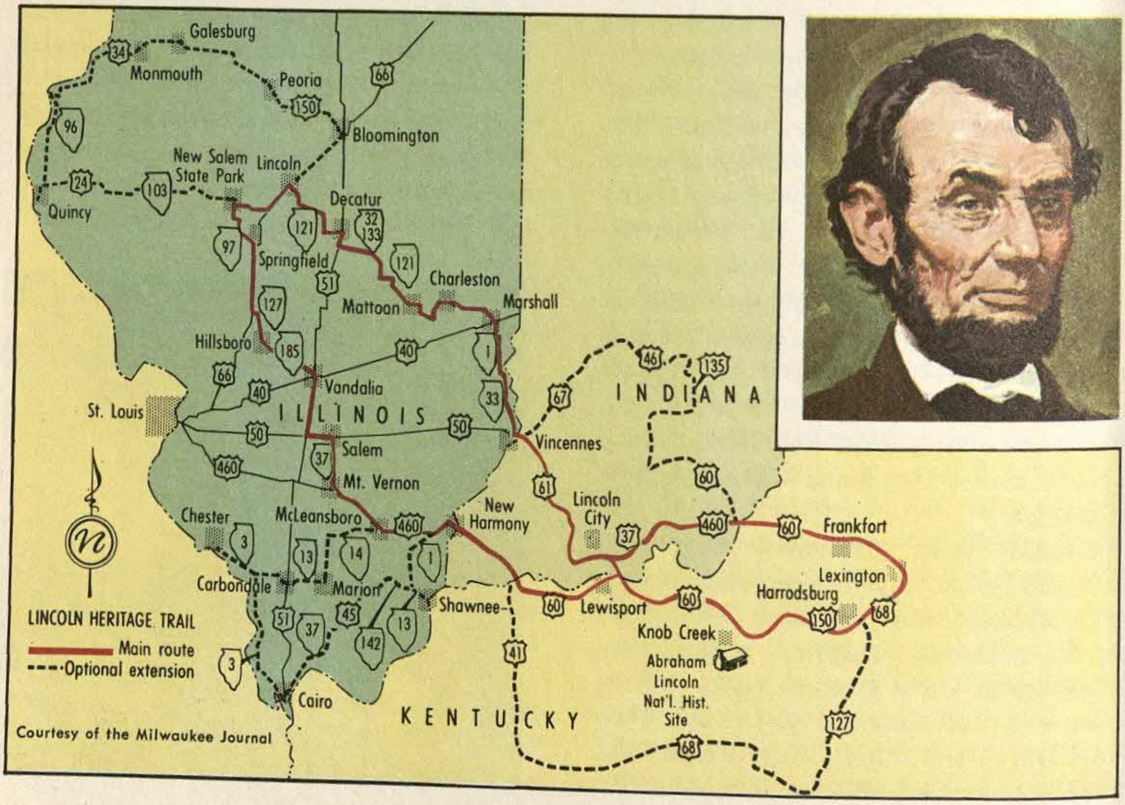
LINCOLN, ABRAHAM (1809–1865) A two-year-old boy toddled through a field after his father, who was planting corn. The two-year-old was helping by dropping pumpkin seeds in some of the hills. Soon after, a heavy rain flooded the field and washed out the seeds. The child was Abraham Lincoln. This planting and the downpour were the earliest happenings Lincoln could remember after he grew up.

Abraham Lincoln was born in a log cabin in Kentucky on Feb. 12, 1809. His father was Thomas Lincoln. His mother was Nancy Hanks Lincoln. He had one sister, Sarah, two years older than he was.

When Lincoln was born, his father owned two farms in Kentucky, two lots in a Kentucky town, and some livestock. His home was only a log cabin, but the homes of the other farmers round about were only log cabins, too. Soon Thomas Lincoln bought a third farm, the farm where Abraham planted the pumpkin seeds.

For several years the family lived on this farm. When their father thought they could spare the time from their chores, Sarah and little Abraham walked to a school two miles away. But they went very seldom.

When Abraham was seven, Thomas Lincoln lost most of his Kentucky land. He decided to move to Indiana. The place he chose for a new home was a little hill with thick woods all around. Winter was coming, and he had to hurry to build some sort of home for his family. There was no time to build a log cabin. Instead he built a "half-faced camp." Three walls were made of logs and boughs. The fourth side was open.



Courtesy of the Milwaukee Journal

A big fire had to be kept blazing there all the time. During the first winter in Indiana the family lived on the game Thomas Lincoln shot. The skins and fur of the animals he killed were a big help in keeping warm.

In the spring Abraham, although he was only eight, helped his father clear a little land for planting. He and Sarah gathered berries in the woods. Sometimes they found some honey. Thomas Lincoln was busy building a better home for his family.

An aunt and uncle came from Kentucky to live near the Lincolns. They brought their son, Dennis Hanks, with them. Dennis was several years older than Abraham, but the two cousins became good friends.

When Abraham was nine, his mother died. So did the aunt and uncle. Sarah kept house for her father and brother and Dennis Hanks. Life was hard for them all.

In a little more than a year Thomas Lincoln married again. His new wife was a widow with three children of her own. She was hardworking and kind. Sarah and Abraham soon loved her.

Abraham's stepmother persuaded his father that Abraham should go to school. He started, but the school soon closed. Two years later he went for a few weeks to another school. It was a "blab" school. The pupils all studied their lessons out loud so that the teacher would know they were working. Altogether Abraham had only about a year's schooling, but he learned to read and write and to do some arithmetic.

Abraham grew tall and strong. He could handle an ax well and was an expert rail-splitter. But he liked to read far better than he liked to plow or split rails. He carried a book with him and often stopped to read a little "to catch his breath."

The Ohio River was not far from the Lincoln home. Abraham at 19 had a chance to go on a flatboat to New Orleans. There he got his first glimpse of a city.

In 1830 the Lincoln family moved to Illinois and settled on the north bank of the Sangamon River. In his first summer in Illinois, Abe, as he was called, split more than 4,000 rails for fences. After only a little over a year here, the family moved to another part of Illinois. But Abe did not go. He chose to strike out on his own.

Lincoln Using Shovel for Calculating

Soon Denton Offcutt, a trader, asked Abe to help take a boatload of corn and pork to New Orleans. Lincoln again saw that city. He saw, among other things, the slave market. When he came back from the trip, Offcutt hired him to work as a clerk in his store at New Salem, Ill.

Lincoln reached New Salem on election day. The schoolteacher, Mentor Graham, was writing down the votes. He looked up and saw the tall young stranger. "Can you write?" he asked. Lincoln said he could. Mentor Graham then asked him to help with the election. The two men soon became good friends. Graham's help made up for the schooling Lincoln had missed.

Lincoln-Douglas Debate

Lincoln was soon well liked in New Salem. He could tell stories well, he could wrestle, and he was so honest he was called "Honest Abe." When fighting broke out with the Indians, Lincoln went to help. He did not get into any actual fighting, but he learned a little about what war meant.

When it was time to elect someone to the state legislature, Lincoln's friends in New Salem persuaded him to run for the office. But he was defeated.

Now Lincoln decided that he would be a lawyer. Offcutt had given up his store, and Lincoln and William T. Berry had started a store of their own. Business was slow. Lincoln had time to read and study law books.

He ran again for the state legislature and was elected. He was reelected three times. He made many trips between the capital of Illinois and New Salem. After his years in the legislature, he moved to Springfield to practice law. He had passed the bar examinations in 1836.

Lincoln was tall and homely and still poor. But Mary Todd, who had always had a fine home and had gone to good schools, fell in love with him. They were married in November, 1842.

Lincoln was elected to Congress from Springfield. But he was not reelected. People did not like his ideas about the Mexican War. He thought the United States should not have fought it. For several years he took almost no part in politics.

A murder trial helped to make him popular once more. Duff Armstrong, the son of one of Lincoln's New Salem friends, was being tried. Lincoln was his lawyer. One witness said that he had seen Armstrong do the killing. It happened at night, but the witness said he could see clearly in the bright moonlight. Lincoln pulled out an almanac. He showed the jury that there had been no bright moonlight that night. Armstrong went free.

By this time there was much talk about slavery. Should new states be allowed to have slaves? Lincoln had hated slavery ever since his trips to New Orleans. He decided to do his part to fight its spread. He ran for Congress again. Stephen A. Douglas ran against him. They went all over the state having debates about slavery. Douglas was elected, but Lincoln won many friends.

Not long afterward Lincoln was nominated for president on the Republican ticket. Again Stephen A. Douglas was running against him. This time Lincoln won. Abraham Lincoln became the 16th president of the United States on March 4, 1861.

The war between the North and the South began in April of the same year. The next years were sad ones for Lincoln. He hated the idea of war. In spite of his worries he tried to make life happy for Willie and Tad, his two small sons. His oldest son, Robert, was in college. Life became even sadder when Willie died. Perhaps Lincoln's sorrows made him more ready to listen to

Assassination of Lincoln—April 14, 1865

the troubles of others. Everyone who came to him for help found him wise and kind.

On Jan. 1, 1863, Lincoln signed the Emancipation Proclamation, which freed all the slaves in the South. In November of that year, he made his Gettysburg Address, one of the most famous speeches ever made.

Lincoln was elected president for a second term. The end of the war came early in April, 1865. On April 14 Lincoln went with Mrs. Lincoln to spend a pleasant evening at Ford's Theater in Washington. While he was watching the play, John Wilkes Booth shot him. For hours the nation hoped that Lincoln might live. But he was too badly wounded. Soon a funeral train was carrying him back to Springfield.

While he was alive many people knew he was a great man. But no one realized how great until after he died. To many people he stands for America. (See CONFEDERATE STATES; DOUGLAS, STEPHEN A.; EMANCIPATION PROCLAMATION; PRESIDENTS OF THE UNITED STATES; UNITED STATES HISTORY.)

LINCOLN MEMORIAL The monument built in Washington, D.C., to honor Abraham Lincoln is very different from the nearby Washington Monument, the tall shaft built to honor George Washington. The Lincoln Memorial is patterned after an ancient Greek temple.

From the steps of the Lincoln Memorial one looks down the long Reflecting Pool toward the Washington Monument. The smooth water of the pool reflects both these memorials to great presidents.

The Lincoln Memorial is built of marble. Although it is not nearly as tall as the Washington Monument, it is not low. The columns alone are 44 feet high—as tall as a three-story building.

Inside the memorial there is a large statue of Lincoln. It was made by the American sculptor Daniel Chester French.

Carved on the stone walls of the memorial are two examples of Lincoln's genius as a speaker. One is his Gettysburg Address. The other is a passage from the address he made when he was inaugurated president for the second time.

Lincoln Memorial, Washington, D.C.

The cornerstone of the memorial was laid on Feb. 12, 1915. But it was not until the 30th of May, 1922, that the building was dedicated and opened to the public.

The Lincoln Memorial is not, as many people think, Lincoln's tomb. Lincoln's tomb is in Springfield, Ill. A tall monument rises above it. (See WASHINGTON, D.C.)

LINEN The cloth we call linen is made from fibers in the stem of the flax plant. No one knows who first discovered that there are strong fibers in flax stems. For linen has been woven for thousands of years. The Egyptians were weaving it long before the pyramids were built. Egyptian mummies were wrapped in linen cloth.

Linen fibers are naturally a pale tan. But they can be dyed beautiful colors. They can also be bleached white. The men who ran for political office in early Rome wore white linen togas. The Latin word for white is *candidus*. So office seekers came to be called candidates—wearers of white.

The first step in making linen is to soak the dried and deseeded flax plants. They may be soaked in ponds, quiet streams, or vats of water, or they may simply be spread out on the grass to soak in the dew. The process is called retting. It lasts until the bark peels easily from the stems. Next the straw is dried and broken up by rollers or a crushing frame. Breaking up the woody stems makes it possible to beat out, or scutch, the fibers. The fibers are baled and shipped to mills. There they are combed and spun into thread.

The cloth woven from linen threads ranges from very fine to very coarse and heavy. Handkerchief linen is one of the finest kinds. Tarpaulin is one of the heaviest. In between come the linens used for tablecloths and napkins, towels, sheets, dresses and suits, and draperies.

Linen fibers are especially strong when they are wet. The finest linen threads are spun when they are wet.

For centuries all linen cloth was woven by hand. The best still is. But most linen is now woven by machine.

Not all the linen thread that is spun is woven into cloth. Some is used in lacemaking. Linen lace can be made that is as delicate as a cobweb. The warp threads of a carpet may be linen. Shoes, saddles, and many other leather articles are stitched with linen thread. (See FLAX; TEXTILES.)

LINNAEUS, CAROLUS (1707–1778) Many doctors have become famous. Linnaeus, a Swedish doctor, is one of them. But he became famous not because he was a doctor but because he worked out a new way of classifying plants. His plan included giving every plant a two-word Latin name —a scientific name—that would help tell what plants are most closely related. No one can see from their common names that the Johnny-jump-up and the pansy are close relatives. But their Latin names tell the story. These names are *Viola pedunculata* and *Viola tricolor.* The scientific name of the cherry is *Prunus avium.* The name of its cousin the plum is *Prunus domestica.* We still use the plan Linnaeus worked out. We use it for both plants and animals.

Even when he was a boy, Linnaeus examined flowers carefully to see all their parts. His father was disappointed because

his son did not wish to be a minister. A doctor friend urged Linnaeus to go to college and study medicine. Linnaeus agreed. He went to universities in Sweden and Holland and became a doctor. But before long he was teaching botany.

Linnaeus took his classes on long walks in search of new kinds of plants. He believed that someday all the plants would be found and named. Now we know that plants change and that there will always be new kinds of plants. His students became interested in his plan for collecting and naming plants. Even after he died many of them went to the far corners of the earth on collecting trips. And for many years after his death, long field trips were taken in memory of him on his birthday—May 21. (See LATIN; NAMES.)

LINOLEUM AND OILCLOTH The material we call oilcloth is well named. It is cotton cloth coated with an oily mixture of clay and color pigments. Linoleum is well named, too. Its name comes from a Latin word, *linum,* which means "flax," and another Latin word, *oleum,* which means "oil." Linseed oil, made from flaxseed, is an important part of linoleum. Powdered wood and chalk—and sometimes cork—are mixed with gum or rosin, pigments, and linseed oil and then pressed on burlap or asphalt-soaked felt. Both oilcloth and linoleum are waterproof.

Oilcloth was once much used as a table and shelf covering. Now newer plastic products have largely replaced it. Linoleum is a common floor covering.

For more than 1,000 years there has been oilcloth. The Chinese used to use it for umbrellas. Linoleum is much newer. It was first made in England in 1860 by Frederick Walton as an easy-to-clean floor covering.

Today there are several kinds of floor coverings much like linoleum. One is asphalt tile. Another is vinyl. They all come in pretty colors and patterns.

Linoleum is made in long 6-foot rolls for carpeting floors from wall to wall, in sheets to use as separate rugs, and in squares that can be arranged on the floor in patterns. The squares are held in place by cement. When properly fastened down, they cannot slip, curl, or crack. (See CARPETS AND RUGS; FLAX.)

Lioness and Cubs

LION The lion is often called the king of beasts. It is not by any means the biggest animal, but it does have a kingly look. Besides, it is powerful and has a loud roar.

The lion belongs to the cat family. It is one of the "big cats." With its heavy mane, a male lion looks the biggest of them all. And it may be 10 feet long and weigh 500 pounds. But a Manchurian tiger, another big cat, may be even larger.

In circuses lions are often in an act with their tiger cousins. In the wild the two animals almost never come together. Tigers live only in Asia and on some of the big islands nearby. Lions live in Africa. There used to be many lions in some parts of Asia, but there are almost none left there. Lions are not jungle animals. They live in open country—grassland or scrubland.

Female lions do not have manes. They are good mothers; they take excellent care of their cubs. Young cubs have faint spots on their bodies. The spots are so close together that they look like streaks. Lion cubs look much more like their tiger cousins than they will when they are older. They play very much like kittens.

Lions are the only cats that live in groups. A group of lions is called a pride. A pride may have as many as 30 lions in it, but most prides are much smaller.

Lions are meat eaters just as all the cats are. They eat chiefly zebras and antelopes. Once in a while a lion becomes a maneater. A lion kills its prey with a swipe of its powerful paw. Female lions do most of the killing. Often lions hunt in pairs. The male lion drives game toward the lioness. Lions do most of their hunting at night.

The king of beasts does not live as long as one might guess. A 25-year-old lion is old for a lion.

Lions make good zoo animals. Many cubs are born in captivity. Laws now protect wild lions. One of the best places to see lions in their native home is in a huge game park near Nairobi in Kenya, a country of eastern Africa. (See CATS.)

LIQUID AIR If air is cooled to far below zero—to about -315°F.—it changes to a liquid. Then it is called liquid air.

Liquid air looks like water. It can be poured like water. But it must be kept in a special kind of container which keeps heat away from it and which keeps it under some pressure. In an ordinary bottle liquid air would quickly boil away.

At the Century of Progress Exposition in Chicago a kettle full of liquid air was always on display. It sat on a big block of ice and boiled merrily. People were puzzled. Was this something that had to be cooled to make it boil? Really it would have boiled faster if it had been on a bare table. Liquid air boils on ice because ice is not cold enough to keep it from boiling. No one could cook potatoes in boiling liquid air. The potatoes would freeze instead.

Liquid air is not safe to handle. It is so cold that it is dangerous. Besides, it is likely to explode.

A rose held in liquid air for a few seconds becomes so brittle that it breaks like thin ice. So does a rubber ball. Mercury can be frozen in liquid air so that it is as hard as iron.

But not much liquid air would be made if it were only good for freezing rubber balls and roses and mercury. When liquid air was first made, some people thought that it would be used instead of steam or gasoline to run engines. But it proved to be too hard to handle. Today liquid air is made because it is easy to get oxygen and nitrogen from it. The air around us is made mostly of oxygen and nitrogen, but it is almost impossible to separate them. It is much easier to separate them if the air has been made into a liquid. Both oxygen and nitrogen are very useful. (See AIR; NITROGEN; OXYGEN.)

LITERATURE The word "literature" comes from "letters." There was no literature until people could write. But not all writing is literature. Much writing is purely useful. No one would call a recipe for cake literature. Neither would anyone call the directions for an experiment or an advertisement for soap literature. Writing is not literature unless the author makes his readers feel a certain way or understand something more fully or act differently. An author handles his words as carefully as a painter handles his colors.

Literature includes writing of many kinds: stories in prose, poems, plays, essays, histories, biographies, arguments, and descriptions. Some stories are short. Others are long enough to fill whole books. Many long stories are called novels. Poems, too, differ greatly in length. Poems that are long and tell stories of heroic deeds are called epic poems. Plays may be either tragedies or comedies. Very light and gay comedies are sometimes called farces.

Every country has its literature. One reason for learning other languages is to be able to read the literature of other lands.

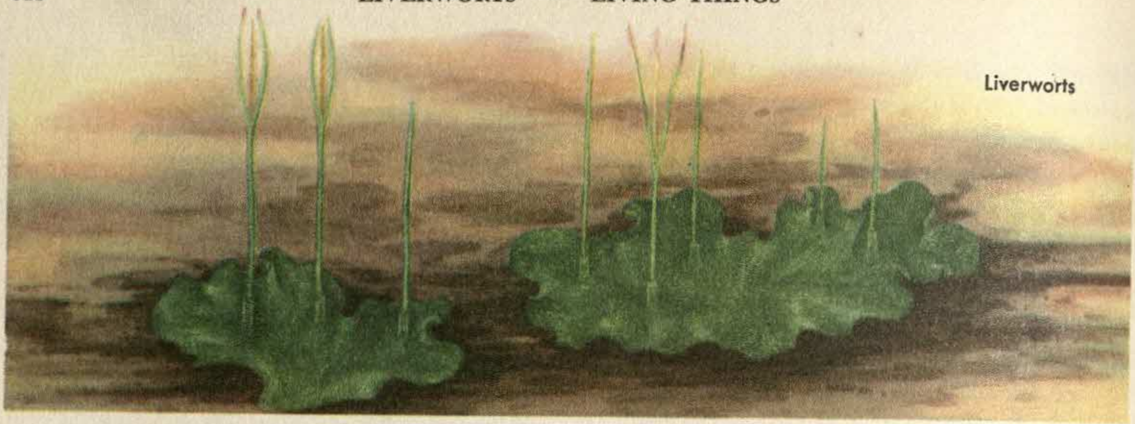
Before the days of printing, the work of writers was within the reach of only a few people. Now it is within the reach of anyone who can read.

The ideas of what is good literature change from time to time. And even at the same time not all people agree as to what is good. The most important question to ask is: Did the author accomplish what he set out to do? Time is the best tester.

The writings that have endured for a long time and are still being read with enjoyment are called classics.

Some writings are so good that they have lived for hundreds or even thousands of years. The *Iliad* and the *Odyssey* go back to the time of the ancient Greeks. So do the fables of Aesop. Shakespeare, the greatest playwright of all time, wrote his plays nearly 400 years ago.

Some authors have written works especially enjoyed by children. Poems and stories make up a large part of children's literature. Many of the characters in these poems and stories are as real to the readers as living people. The pictures here are reminders of a few of the interesting characters waiting inside the covers of books. (See AESOP; AMERICAN WRITERS; ENGLISH WRITERS; HOMER.)



Liverworts

LIVERWORTS The damp walls of ravines are sometimes covered with little plants called liverworts. Liverworts also grow on fallen logs, on trees, and on the ground in damp, shady places.

Liverworts have no stems or roots or true leaves. In many cases a whole plant looks rather like a single leaf.

These little plants never bloom. They do not have seeds. Liverworts are scattered chiefly by tiny spores. The slender stalks on the liverworts in the picture are the spore-producing parts of the plants.

New liverwort plants may also grow from buds about as big as the head of a pin. The buds are formed in little cups.

Liverworts are not at all important now. We do not eat them, and they do not produce anything we need. But they have a very important part in the story of plants. They were, scientists think, among the very first plants ever to live on land. They first appeared some 400 million years ago. Their ancestors were supposedly plants that grew in the waters of coastal swamps.

Moving from water to land was an enormous step. On land wind and sun make water evaporate fast. A plant must be able to take in enough water to replace what it loses. Liverworts solved the problem by clinging close to damp rocks or bark or soil and remaining small.

No one would miss liverworts much if they all disappeared. But just suppose no plants had ever ventured up on land. How different the earth would be today! (See EARTH HISTORY; PLANT KINGDOM.)

LIVING THINGS Blue jays and poppies do not look very much alike. But they *are* alike in a number of ways. They are alive. They grow. From them can come other living things almost exactly like them. Both blue jays and poppies must have water and oxygen. They must have food, too. It is true that a poppy does not eat the way a blue jay eats. Clearly it does not live on the same kind of food, either. Instead, it makes the food it needs out of water and materials from the air around it and from the soil it grows in. But it cannot live without food any more than a blue jay can.

Both the blue jay and the poppy move. Of course, a poppy does not go flying about from one place to another, but there is movement inside a poppy plant just as there is inside a blue jay's body. Besides, a poppy's leaves turn this way and that toward the sunshine.

Both the blue jay and the poppy, moreover, are built up of tiny blocks of living

Blue Jay

material called cells. The living material itself is called protoplasm.

In the whole world there are about a million and a half kinds of living things. They are all alike in many ways. Needless to say, there are endless ways in which living things may differ from one another.

Living things may be very different in size, as we realize when we think of a whale and a mouse or of a dandelion and a redwood. And there are thousands of living things that are smaller than mice and dandelions. There are hundreds and hundreds too small to be seen without a microscope.

The blue jay and poppy show that living things may be very different in color. Some, moreover, have no color at all.

Of course, some living things are plants and some are animals. No one needs to be told that a poppy is a plant. Some people may not know that a blue jay is an animal. But it is. Birds make up one of the big groups of animals.

Many people think that an animal has to have fur. They get the words "animal" and "mammal" mixed up. Mammals are the group of animals that cats and dogs and lions and tigers and horses and cows and we ourselves belong to. They all have hair or fur. But mammals are only a small part of the whole animal kingdom. Insects, spiders, toads, snakes, fishes, lobsters, snails, worms, and jellyfish are some of the many animals that do not have fur.

In the same way, some people think that plants have to be rather small, like poppies. They do not understand that bushes, trees, vines, and giant seaweeds are also plants.

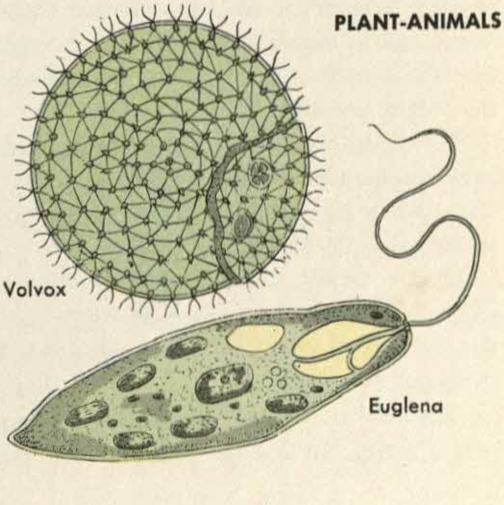
A few kinds of living things are puzzles. It is hard to tell whether they are plants or animals. For a long time people thought that sponges, which never move about, were plants. Some other animals look so much like plants that they were given flower names. The sea anemone and the sea lily are two of them. But by studying sponges and sea lilies and sea anemones scientists have found out that they are really animals.

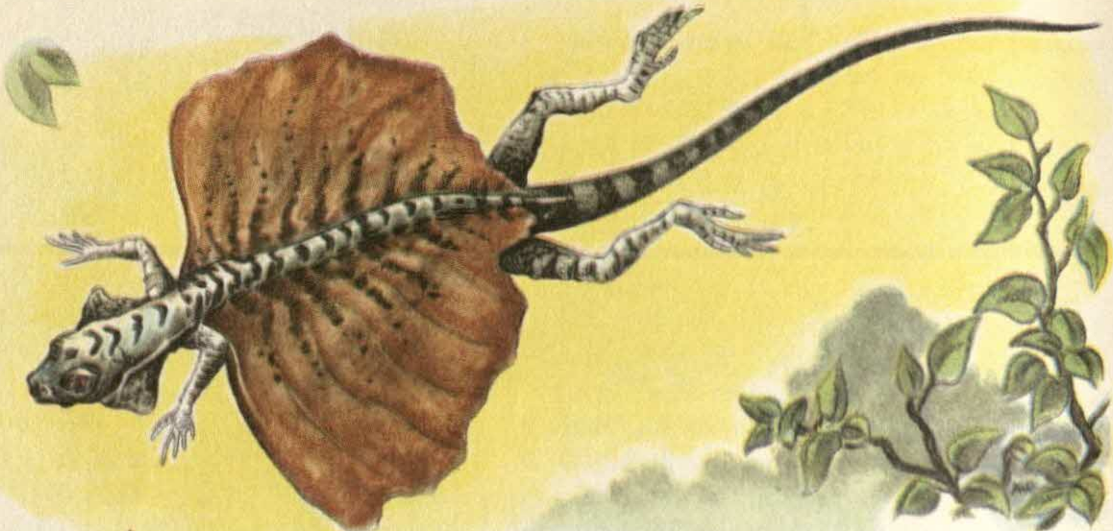
Poppy

There are, however, some real puzzlers among living things. The picture at the bottom of the page shows two of them as they look through a microscope. They are green, like most plants, but they move about like tiny animals. What should they be called? They are sometimes called plant-animals. Some scientists solve the problem in another way: They put these and other such puzzling organisms in neither the plant nor the animal kingdom. They put them instead in a kingdom called the protists.

As a rule the puzzling cases are tiny. Many are made of only a single cell. Most of the vast number of living things are clearly either plants or animals. (See ANIMAL KINGDOM; BIOLOGY; CELL; PLANT KINGDOM; PROTISTS.)

PLANT-ANIMALS





Flying Dragon

Lined Whiptail Lizard

Collared Lizard

Chuckwalla

LIZARDS The little chameleon (ka ME le un) is the only lizard many people know. It is often sold as a pet. But there are about 2,500 kinds of lizards. They are most common in warm regions.

Lizards are reptiles. They are therefore cousins of the snakes, turtles, alligators, and crocodiles. They are most closely related to the snakes. But from the looks of most of them no one would guess that they are. Only a few lizards are legless like snakes. One of these looks so much like a snake that it is called the glass snake. Most lizards have four legs. Some can run about on only their hind legs.

The animal called the horned toad is misnamed just as the glass snake is. It is really a lizard. It has scales just as all lizards do. No toads have scales.

Most lizards are land animals. Many of them are good climbers. A few live underground. And one, the flying dragon, has "wings." Its wings are folds of skin that act as parachutes. Some lizards spend much of their time in the sea.

The biggest animal in the group is the dragon lizard of the East Indies. This lizard may be 10 feet long and weigh 300 pounds. It can catch and eat a wild pig.

Many lizards eat animals. Others live on plants. Still others eat both. Some have remarkable tongues. An eight-inch chameleon can shoot out its tongue another eight inches to catch an insect.

The chameleon is famous also because it changes color. Some other lizards change color, too.

Some lizards are noisy. Those called geckoes chirp or croak or even bark.

A lizard has a strange way of escaping an enemy. It can run off leaving its tail behind. Later it grows a new tail.

Only two lizards are poisonous. One is the Gila (HE la) monster of southwestern

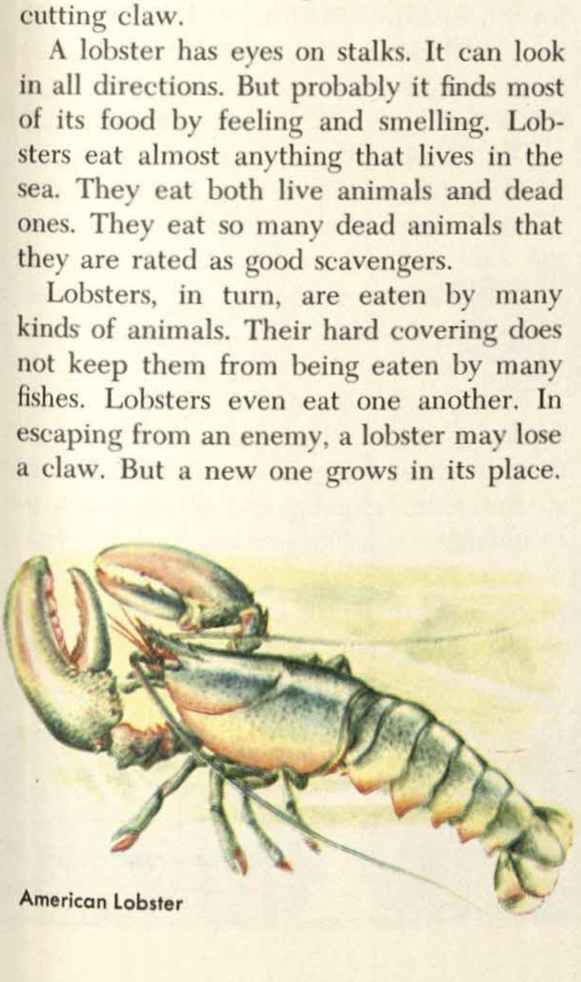
United States. The other is the Mexican beaded lizard. It is a close relative of the Gila monster. Most lizards are helpful because of the troublesome insects they eat. (See ADAPTATION TO ENVIRONMENT; REPTILES; SNAKES.)

LOBSTER The lobster is one of the many animals that live in the sea. In warm weather lobsters stay in shallow water close to shore. In cold weather they travel out, perhaps for 50 miles, to deeper water. The American lobster lives on the Atlantic coast northward from North Carolina.

A lobster spends most of its time walking about on the ocean floor. It uses four of its five pairs of legs for walking. The legs of the other pair end in big claws. These claws are good weapons against enemies. Besides, they help in food getting. The bigger of the two is the crushing claw, the other the cutting claw.

A lobster has eyes on stalks. It can look in all directions. But probably it finds most of its food by feeling and smelling. Lobsters eat almost anything that lives in the sea. They eat both live animals and dead ones. They eat so many dead animals that they are rated as good scavengers.

Lobsters, in turn, are eaten by many kinds of animals. Their hard covering does not keep them from being eaten by many fishes. Lobsters even eat one another. In escaping from an enemy, a lobster may lose a claw. But a new one grows in its place.


American Lobster

A lobster dinner is a great treat to most people. The big claws and the tail furnish the meat. Lobsters are caught in traps called lobster pots. A common sight along the New England coast is a fisherman tending his lobster pots. Millions of lobsters are caught and sold every year.

Many people who have seen only cooked lobsters are surprised to find that lobsters when they are alive are not bright red. They are mostly green instead.

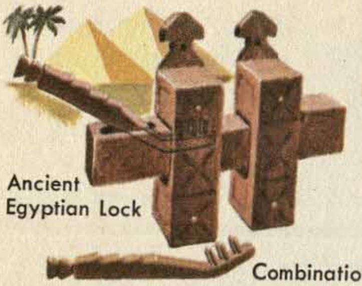
A mother lobster lays thousands of eggs at a time. She glues them to the underside of her body and carries them around for ten months or so. Then the baby lobsters hatch and go swimming about. For some weeks they stay near the surface of the water. Then they move to the bottom.

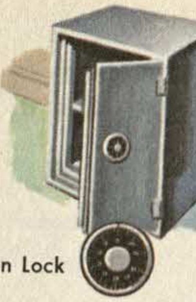
A young lobster grows fast. As it grows it has to shed its hard coat from time to time and get a new one. Changing coats in this way is called molting. A lobster molts many times during its life. It takes lobsters five or six years to grow up. A lobster may grow to be two feet long and weigh 30 pounds, but few are that big.

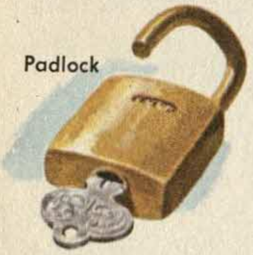
Lobsters belong to the group of animals called crustaceans. This group includes the crabs, shrimps, spiny lobsters, and crayfishes, too. (See CRUSTACEANS.)

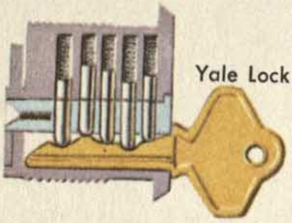
LOCKS "Keep it under lock and key" is another way of saying "keep it safe." For many hundreds of years locks and keys have meant safety for people and their possessions. Even the ancient Egyptians had locks and keys.

The picture on page 822 shows a few of the many locks that have been invented. All of them but one have keys. The one with no key is a combination lock. A knob must be turned to work it. It is called a combination lock because a person must use a combination of numbers to unlock it. Perhaps the combination is R7–L2–R5. The knob must be turned right (R) till the pointer points to 7. Then it must be turned left (L) to 2 and right (R) again to 5.


Ancient Egyptian Lock


Combination Lock


Padlock


Yale Lock

In every lock there is a bolt of some sort. The key or knob moves the bolt. The key, if there is one, must be cut in a special shape to do so.

The Yale cylinder lock was invented by Linus Yale in 1860. The picture shows how a Yale lock works. The key moves little rods, or pins, and frees the bolt to move.

Bank vaults have large combination locks, They are much like the little combination lock on the safe in the picture. The knobs must be turned in just the right way to do the unlocking. Only a very few people are allowed to know the combination for a bank vault. Some locks on vaults are time locks. They are set so that even with the right combination they cannot be opened until the time they are set for. Time locks have to have clockworks built into them.

Today almost every grown person in towns and cities carries about several keys —door keys, car keys, and others besides. It is good that keys are as small as they are. In early times many were a foot long!

LOCOMOTIVE Big engines that pull trains or huge devices such as launching rockets are called locomotives. Most locomotives are run either by steam, by electricity, or by diesel-electric power.

Steam locomotives came first. They were nicknamed "iron horses." The earliest ones did not look much like the locomotives we are used to seeing today. They were steam engines set on wooden platforms with wheels. The first really good steam locomotive was the "Rocket." It was built in England by George Stephenson and won a prize in a competition there in 1829.

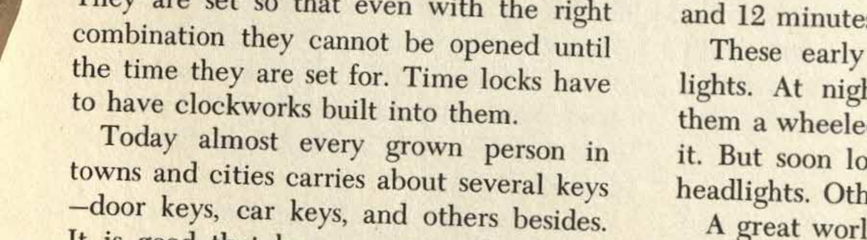
In the same year the "Stourbridge Lion" was brought to the United States from England. Soon steam locomotives were being built here. Two famous early ones were the "Best Friend of Charleston," and the "Tom Thumb."

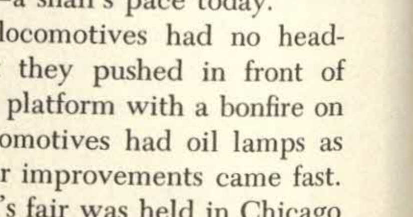
The "Best Friend of Charleston" ran for several months. Then one day a new fireman tied down the safety valve of the steam engine. The hiss of the escaping steam annoyed him. The engine blew up.

The "Tom Thumb" became famous when it ran a race with a horsecar. The "Tom Thumb" passed the horsecar but lost the race just at the end because a belt slipped. But on another day it set a speed record. It traveled 13 miles in one hour and 12 minutes—a snail's pace today.

These early locomotives had no headlights. At night they pushed in front of them a wheeled platform with a bonfire on it. But soon locomotives had oil lamps as headlights. Other improvements came fast.

A great world's fair was held in Chicago in 1893. In that year the engineer of locomotive 999 of the New York Central road


Electric Locomotive


Diesel Locomotive

set out to break the world's speed record for trains. He did. The 999 pulled the Empire State Express faster than any train had ever traveled before. At its fastest it was going nearly two miles a minute. The 999 was put on exhibit at the fair.

Locomotives were needed for freight as well as for passenger trains. They had to be powerful rather than fast. The Moguls and Mikados were among those built for hauling freight.

As locomotives for pulling freight grew longer, the sharp curves of mountain railroads became a problem. For mountain freight service, articulated locomotives were built that worked as if they were jointed. One of them, "Big Boy," is said to be the largest steam locomotive ever made.

Steam locomotives send out smoke. They sometimes give off sparks. They are rather noisy. In cities, in places where railroads go through forests, and in tunnels, the noise, smoke, and sparks are a nuisance. The sparks may even set a forest on fire. In the early 1900's electric locomotives began to replace those run by steam in many such places. Electric locomotives have big electric motors in them. The electricity to make them run may come by overhead wire or third rail.

In the United States and in many other countries, too, diesel-electric locomotives have pushed steam locomotives out of the picture. Diesel electrics are electric locomotives that carry their own power plants inside them. Diesel engines, burning fuel oil, drive electric generators to furnish the current for the motors that actually drive the locomotives.

There are some gas-turbine electric locomotives, too. In them the generators are driven by turbines turned by the hot gases from burning fuel.

Today locomotives are being made that can pull trains at very high speeds. In 1964 Japan built a railroad between Tokyo and Osaka for trains traveling 130 miles an hour. Similar high-speed trains are in operation in the United States and Canada. (See ENGINES, HEAT; RAILROADS.)

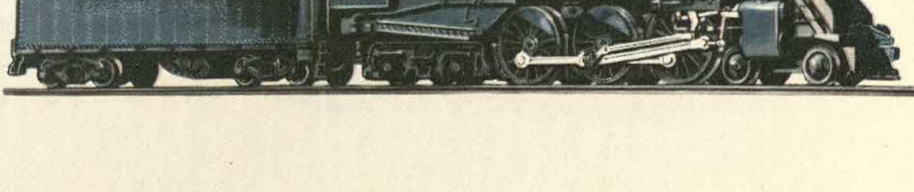
"Stourbridge Lion"

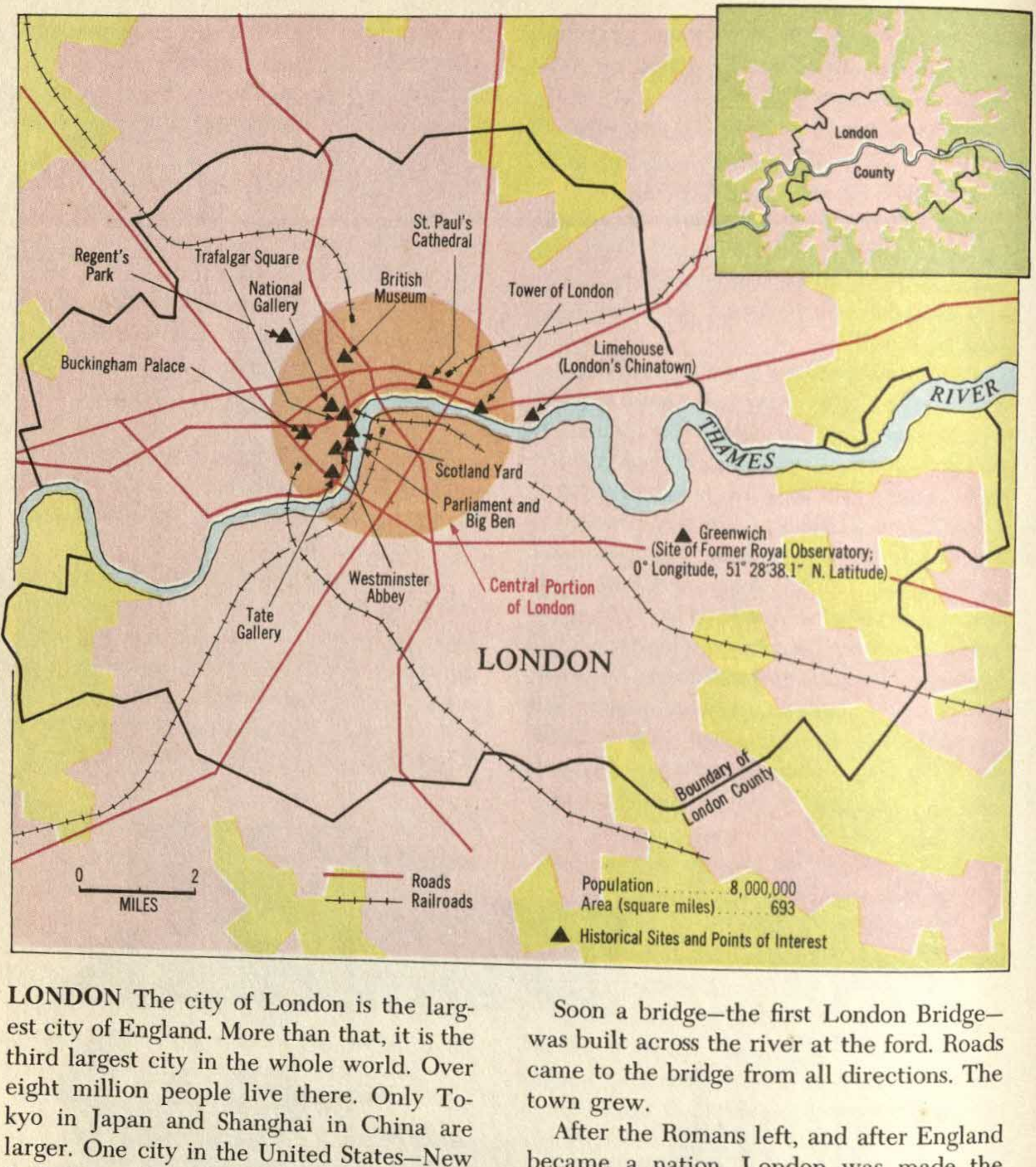
999

"Tom Thumb"

Mogul

Modern Steam Locomotive




London
County
Regent's Park
Trafalgar Square
National Gallery
British Museum
St. Paul's Cathedral
Tower of London
Limehouse (London's Chinatown)
Buckingham Palace
THAMES RIVER
Scotland Yard
Parliament and Big Ben
Greenwich (Site of Former Royal Observatory; 0° Longitude, 51° 28'38.1" N. Latitude)
Westminster Abbey
Central Portion of London
Tate Gallery
LONDON
Boundary of London County
0 2
MILES
Roads
Railroads
Population..........8,000,000
Area (square miles).......693
Historical Sites and Points of Interest

LONDON The city of London is the largest city of England. More than that, it is the third largest city in the whole world. Over eight million people live there. Only Tokyo in Japan and Shanghai in China are larger. One city in the United States—New York—is nearly as big as London.

London has had a long time to grow to be one of the world's largest cities. Its story begins nearly 2,000 years ago, when Britain was a part of the great Roman Empire. London was first a little village at a place on the Thames River where the river was narrow enough and shallow enough to be crossed on foot. Farther downstream the Thames was too wide and deep to be forded.

Soon a bridge—the first London Bridge—was built across the river at the ford. Roads came to the bridge from all directions. The town grew.

After the Romans left, and after England became a nation, London was made the capital. The kings and queens lived there. As England built up a great empire, London became the whole empire's capital.

Tides come up the Thames River as far as London. Below the city the river is deep enough at high tide to let oceangoing boats sail up the 60 miles from the sea. Sea trade helped London grow. After the coming of railroads, they, too, helped in the city's growth. Today London, chief city of the

British Commonwealth of Nations, is one of the greatest trading centers of the world. Ships from the seven seas bring cargoes to her docks. The ships sail away carrying cargoes brought to the docks by road and railroad from all over Britain. London itself has many factories. Since it is a great center of trade, it is not surprising that London also has many world-famous banks which handle the finances of trade.

London does not look at all like New York. Since it is a very old city, many of its streets are narrow and crooked. There are no skyscrapers like those in New York. The soil under London would not make a good footing for skyscrapers. Buildings even ten stories high are uncommon. As it grew bigger, London had to grow out instead of up. It swallowed village after village.

A visitor in London has many sights to see. The Houses of Parliament, where the work of governing the United Kingdom and its territories is carried on, stand on the north bank of the Thames. No. 10 Downing Street is the home of the prime minister. Westminster Abbey is the great church where many famous Englishmen are buried. Buckingham Palace is the London home of the ruling monarch. The British Museum is one of the world's finest museums. In Kew Gardens there are plants from all over the world. The Tower of London served as a prison for many famous prisoners—some of them kings and queens. Now the crown jewels are kept there. Scotland Yard is the home of the London police. St. Paul's Cathedral, which stands on a low hill, is a landmark of London. It is the work of the famous architect, Sir Christopher Wren.

London has great markets, some of them very old. Most interesting of all the sights to some visitors are the docks. Here there are always boats from many lands. Seeing them makes the visitor realize that from London there is a road to everywhere. Today many of these "roads" are skyways. London Airport is one of the busiest in the world. (See ENGLAND.)

LONGFELLOW, HENRY WADSWORTH (1807–1882) The poet Henry Wadsworth Longfellow is one of America's famous writers. He was born in Portland, Me. When he was 13 years old a Portland newspaper published one of his poems. This poem, which was about an Indian fight, was signed "Henry."

Longfellow graduated from Bowdoin College in Maine and spent the following three years in Europe. Returning home, he became a professor at Bowdoin. In 1836 he began teaching at Harvard University in Cambridge, Mass.

Sometimes Longfellow wrote poems about his own children—two sons and four daughters. One daughter died when a year old. The other girls are mentioned in "The Children's Hour" as "grave Alice and laughing Allegra, and Edith with golden hair." Edith was also the child in the poem about the little girl who had a curl in the middle of her forehead. Sometimes she was good, "but when she was bad she was horrid."

Longfellow was the first American to write long poems successfully. Among these are: *Evangeline*, *The Song of Hiawatha*, and *The Courtship of Miles Standish*. Among his other well-known poems are: "Paul Revere's Ride," "The Skeleton in Armor," "The Wreck of the Hesperus," "The Village Blacksmith," and "Excelsior." (See AMERICAN WRITERS.)

LONG MOSS Hanging from the trees in the cypress swamps of the South are great streamers of long moss. Long moss also drapes the live-oak trees on southern lawns. It will use any tree as a perch. It may even hang down from telephone wires.

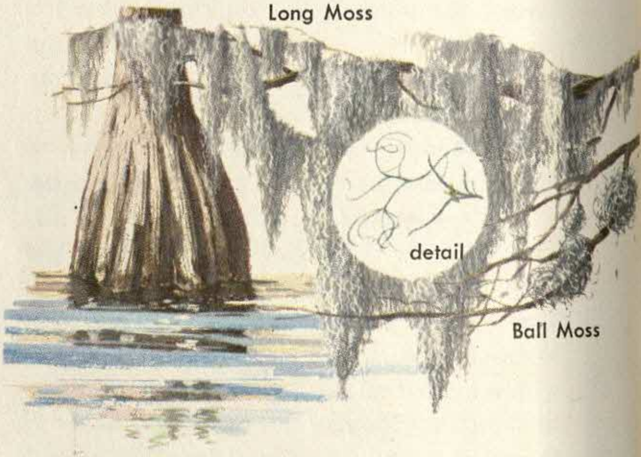
Long moss is a plant with long stems, and leaves as slender as threads. Both the leaves and the stems are covered with silvery hairs. These hairs give the plant a gray color in dry weather.

Long moss has no roots. It takes in water through the hairs. It has flowers, but not many people notice them. They are tiny and yellow-green. Its seeds are formed in very small pods. When the pods open, the wind blows the seeds away. Some of them find a perch and can start growing.

Long moss does not harm the trees on which it grows. It takes neither food nor water from them.

Florida moss, black moss, and Spanish moss are other names for long moss. None of its common names are really good, for this plant is not a moss. Strangely enough, it belongs to the pineapple family.

Long moss is useful as packing material. Some people earn their living by gathering it. (See EPIPHYTE.)



LOS ANGELES In 1769 some Spanish explorers traveling north from Lower California came to an Indian village standing where Los Angeles is now. They named the village *Nuestra Señora la Reina de Los Angeles* (Our Lady Queen of the Angels). They moved on. But soon Spanish priests set up a mission only a few miles from the village. And in 1781 a band of settlers, mostly Spanish or Spanish-Indian, arrived after a 100-day march over the desert from Mexico. They built for themselves adobe houses with red-tile roofs.

The place was a good one for settlement. There was level lowland for fields, and water to irrigate them. The hillsides round about furnished grass for cattle and sheep. More settlers came. Crops of wheat and olives were good. In time the little town became a trade center. By 1846, when California became a part of the United States, the long name of the village had been shortened to Los Angeles.

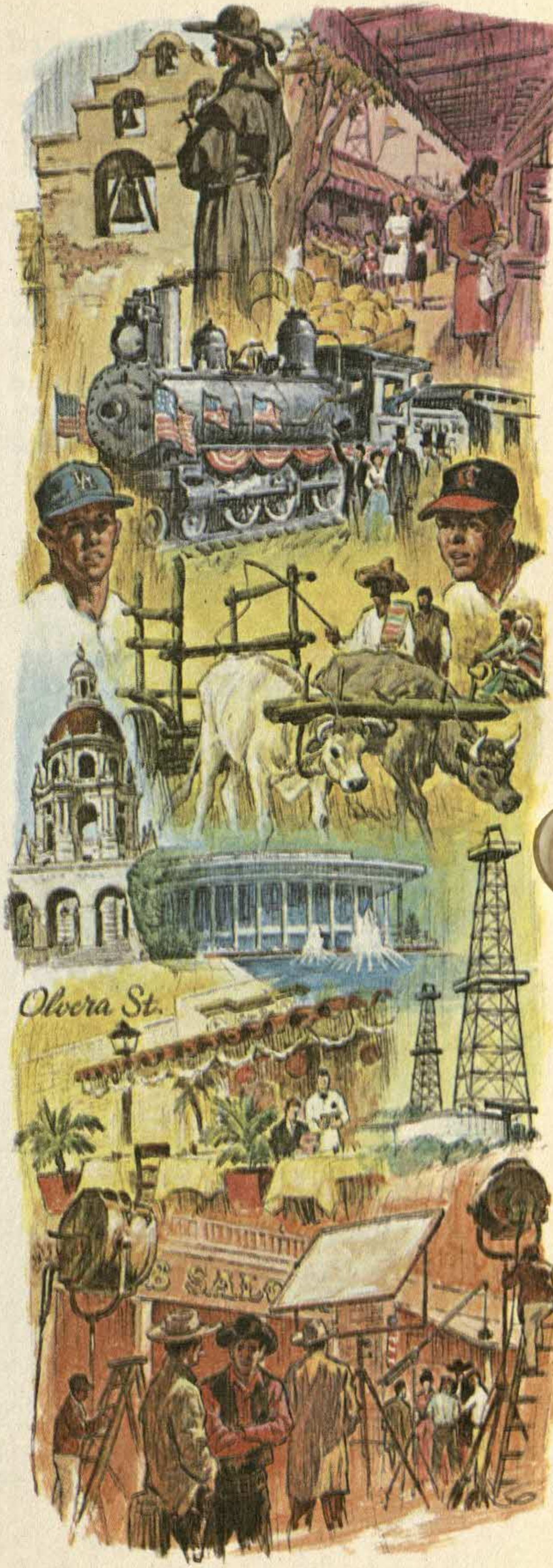
Los Angeles became a city after railroads crossed the continent to the west coast. Trade increased. Citrus fruit was shipped east, and manufactured goods were brought back. Newcomers and tourists came to enjoy the pleasant climate and beautiful scenery. Just before 1900, Los Angeles began to grow fast.

The motion-picture industry was one of the first great industries to help Los Angeles grow. The varied scenery and the sunny days aided this industry. After oil was discovered nearby, the city became a great oil-refining center. It produces large quantities of gasoline and fuel oil.

Today one of the largest industries in the Los Angeles area is the making of airplanes. Weather conditions are good for work outdoors and for test flying. Another industry for which Los Angeles is now famous is the making of sportswear. People find work in many other factories, too—canneries and frozen-food plants, packinghouses, oil refineries, and even steel mills. The city is a busy workshop in a beautiful setting.

As their city began to grow, the people of Los Angeles saw the need of ships as well as trains to handle their business. They needed a harbor. About 20 miles south of the city there was a little harbor at San Pedro. Los Angeles added this town to the city and, over 50 years ago, built a modern harbor there. Los Angeles is now the largest seaport on the west coast. It has three nearby airports. From its International Airport, airlines go to lands around the world as well as to other parts of the United States. A great network of freeways feeds into the city.

Today the little Indian village has become a sprawling giant, the third largest city in the United States. It is the home of several of the country's famous schools.



LOUISIANA Of the states carved out of the Louisiana Purchase, this Gulf state shows more signs of its French beginnings than any other. The French named the region in honor of their king, Louis XIV. Spain gained control in 1762 and governed until shortly before 1803, when the United States bought it from France. In 1812 Louisiana joined the Union as the 18th state. Many Louisianians are descendants of the early French and Spanish settlers. They are known as Creoles. Louisiana is nicknamed the "Creole State." Some of the people still speak French, follow French customs, and cook French foods. In New Orleans visitors see French and Spanish houses built around courtyards and ornamented with lacy ironwork balconies.

Early settlers came to the Louisiana country from France and from French Canada in the 1700's. Their journeys were long and hard. They were eager to make homes for themselves in the new land. With the help of slaves many of the settlers cleared forest lands, set out great plantations, and grew indigo, sugarcane, rice, and cotton. In building their homes some of the settlers copied Indian houses with walls of cypress wood and clay mixed with Spanish moss. Because of frequent river floods some built stilt houses raised six or more feet aboveground. People traveled on the rivers in hollowed-out logs called pirogues. The rivers formed pathways through the woods.

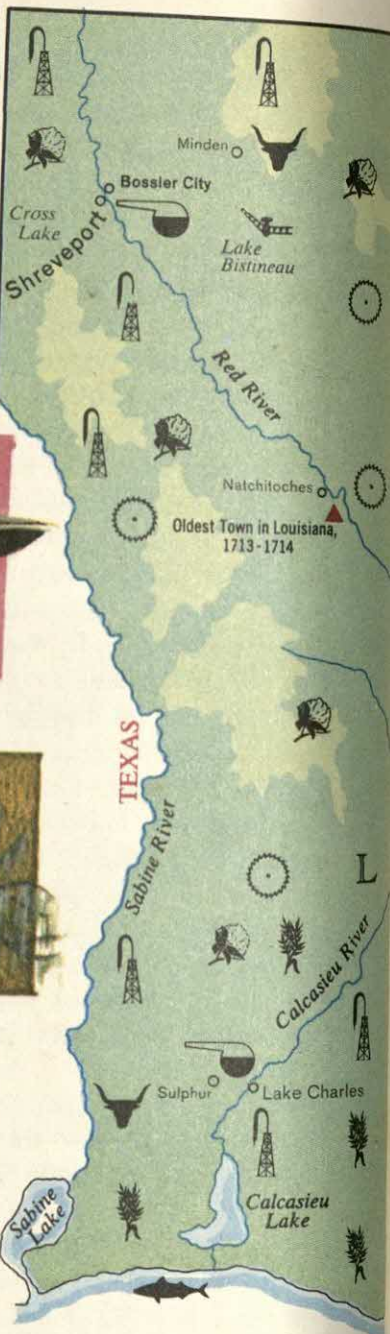
Later, American settlers, like the French, had large cotton, rice, and sugar plantations. Much of the plantation land is now divided into farms. Some settlers cleared smaller plots of land in the forests and raised corn, hogs, and cattle.

Louisiana is also called the "Sugar State." The Mississippi Delta is well known for its sugarcane. Here the growing season is long, the soil is rich, and there is plenty of hot weather, sunshine, and rain. Trucks piled high with stalks of sugarcane haul the cane to mills to be crushed.

Mardi Gras

State Flower: Magnolia

State Bird: Brown Pelican

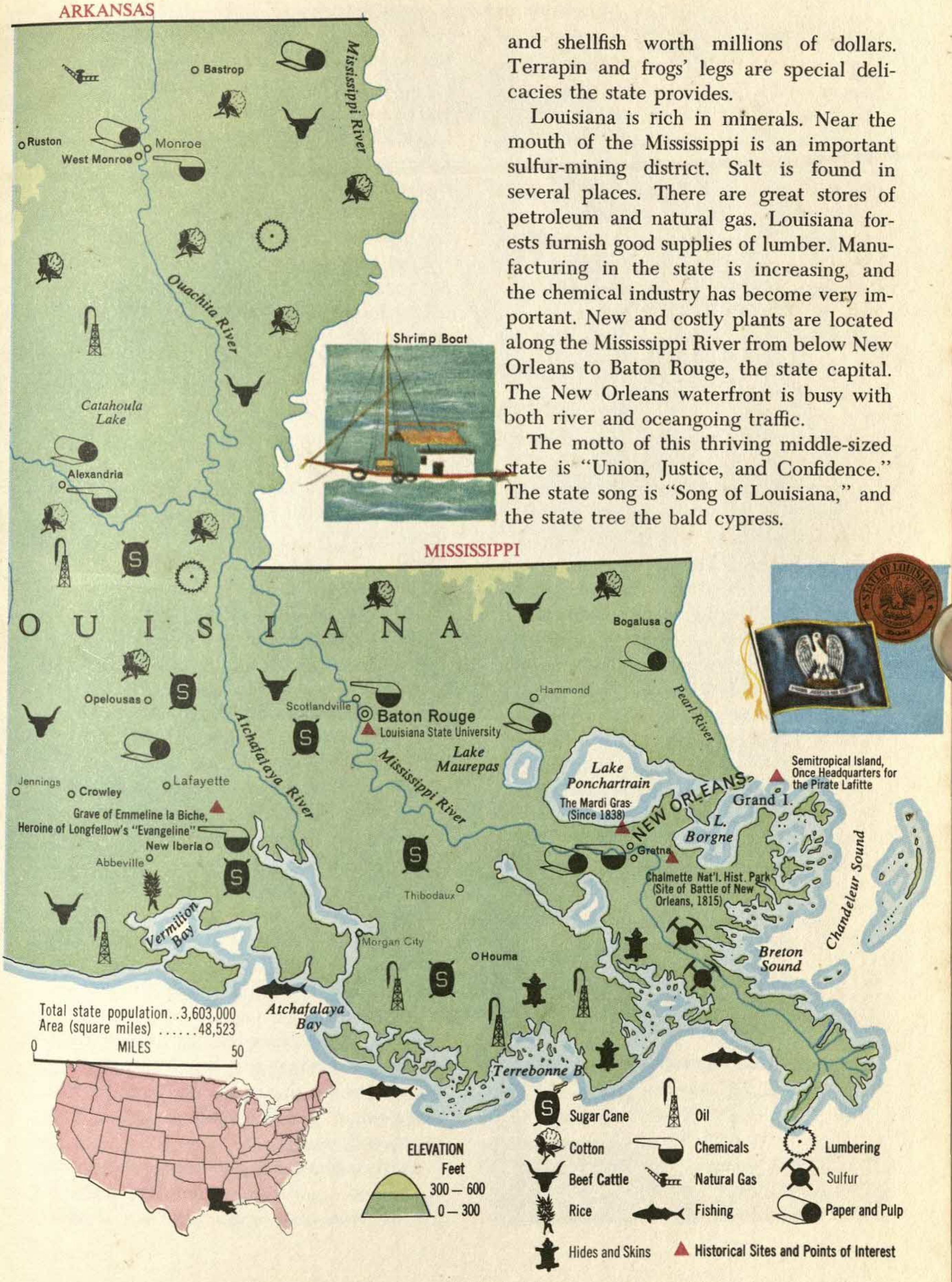


Louisiana farmers raise rice along the Gulf coast west of the Mississippi. Although rainfall is heavy here, the farmers flood the fields to make sure of enough water. North of the rice and sugar belts they grow cotton. Pecans and strawberries are other leading crops of the state.

Trapping muskrats is a good business in the wet, grassy marshes of the delta. Every year from Louisiana waters come fish and shellfish worth millions of dollars. Terrapin and frogs' legs are special delicacies the state provides.

Louisiana is rich in minerals. Near the mouth of the Mississippi is an important sulfur-mining district. Salt is found in several places. There are great stores of petroleum and natural gas. Louisiana forests furnish good supplies of lumber. Manufacturing in the state is increasing, and the chemical industry has become very important. New and costly plants are located along the Mississippi River from below New Orleans to Baton Rouge, the state capital. The New Orleans waterfront is busy with both river and oceangoing traffic.

The motto of this thriving middle-sized state is "Union, Justice, and Confidence." The state song is "Song of Louisiana," and the state tree the bald cypress.

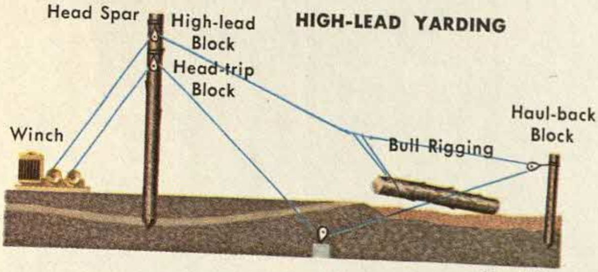


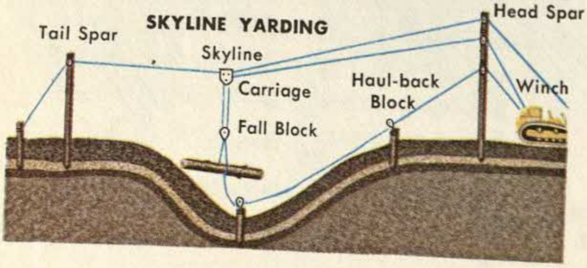
LUMBERING Far and wide over the world lumbering is an important industry. It is one that calls for a great deal of strength and skill. Among the colorful stories of America's pioneer days there are many about lumber camps and the lumberjacks that worked in them. Today a lumberman's life is not as rough as in earlier times.

Logging—cutting down the trees and getting them out of the forest—differs with the place, the size of the forest, and the kind of tree. The United States, for instance, has no elephants to help drag out the logs as elephants do in the teak forests of Burma.

In a big western forest of the United States different workers have different jobs. Some are fallers, or fellers. They cut down, or fell, the trees. After a faller has chosen a tree to cut, he decides in what direction it should be made to fall. He wants it to do as little damage as possible to itself and nearby trees. With a chain saw he can cut through a six-foot trunk in two minutes. The tree crashes down. The faller has guided the saw so well that the tree falls just as planned.

Limbs are cut off the fallen tree. Then buckers cut it into log lengths. The logs may travel away from the forest on flatcars. They may travel by truck. Trucks loaded with logs are a common sight on western roads.





It is no easy job to get the logs to landings to be loaded. Tractors may pull them. Or they may be moved with cables in the ways shown in the diagrams. In both skyline and high-lead yarding the cables are fastened to spars—tall trees that have been topped by high climbers. Chokers fasten chains around the logs. Their job is one of the most dangerous in lumbering.

Logs may be taken away from a forest by water. In some places great troughs called flumes have been built. The water of a mountain stream is sent down the flume. The water makes the flume so slippery that logs slip down it easily. Some logs travel down the streams themselves. When they reach a big river or a lake or the sea, they may be tied together in rafts. The logs are light enough to float.

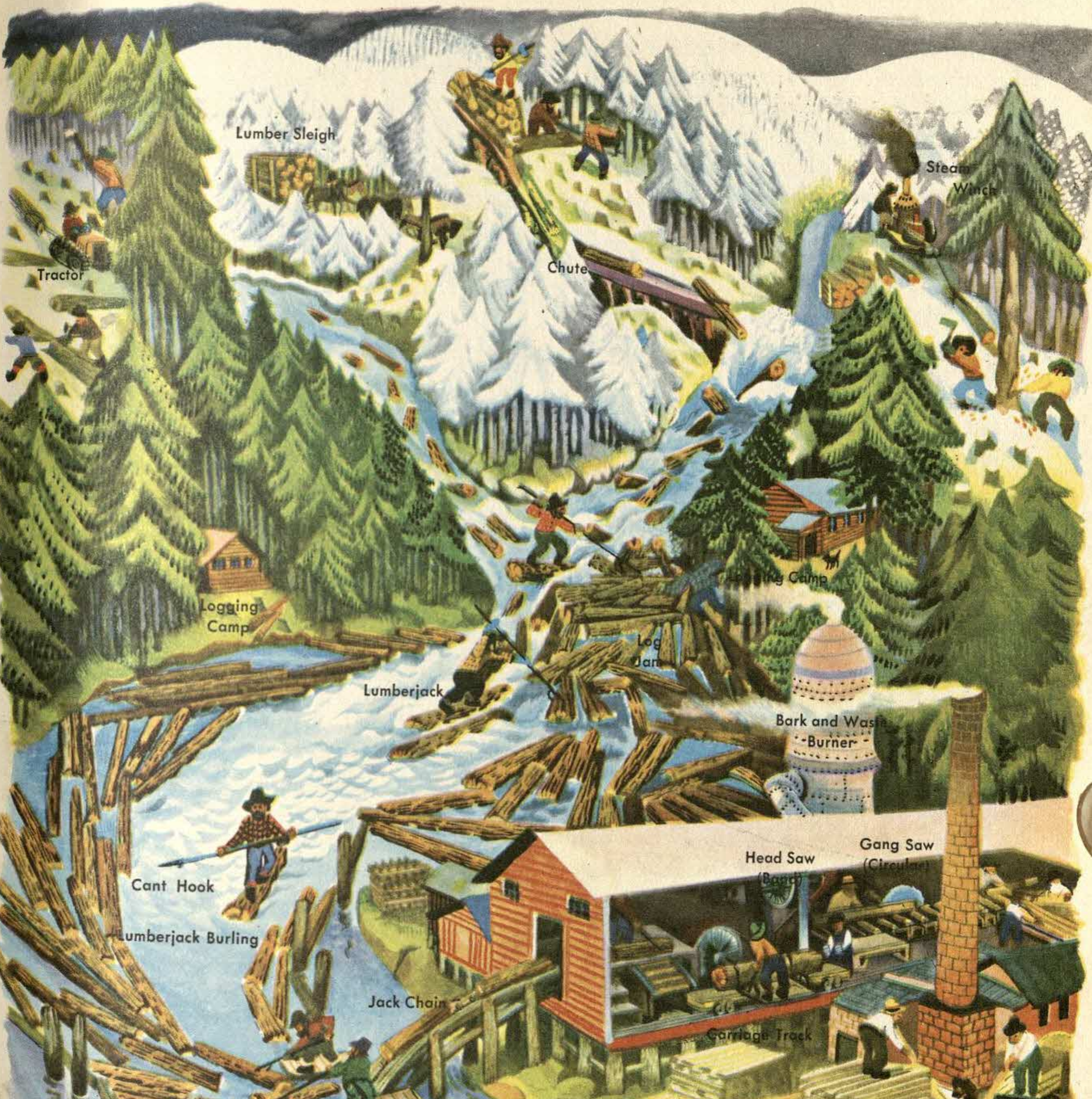
Not all logs become lumber. Some go to paper mills to be made into paper or to rayon mills to be made into fabrics. Some become telephone poles. But many do go to sawmills to be cut into lumber.

Skilled lumbermen know how to cut logs to get the most and the best boards out of them. Lumber is sold by board feet. A piece of lumber 1 foot wide, 1 foot long, and 1 inch thick is a board foot. A piece of lumber 12 feet long, 1 foot wide, and 1 inch thick measures 12 board feet. There used to be much waste at sawmills. Now the scraps are used for making such things as hardboard, and artificial logs for fireplaces.

In plywood mills a log, instead of being made into boards, is cut into very thin sheets. Several of these sheets, or veneers, are then piled up and glued together. Thin veneers of very valuable wood may serve as a covering for cheaper woods.

Some of the trees cut for lumber from American forests are hardwoods—broad-leaved trees such as oaks and maples. Far more are softwoods—conifers such as firs, pines, and spruces.

Early in the history of the United States it seemed that trees would last forever. People were very wasteful. Care is now



being taken to make the forests last. There are different plans of harvesting trees so that they will. In some cases all the trees are cut from a large area, and seedlings are planted at once. In others 100 acres or so are cleared inside a forest and the reseeding is left to the trees round about. A third plan is to leave a few trees on every acre to do the reseeding. And in some hardwood forests only trees that have reached full size are cut out of a stand. These plans are working so well that foresters feel sure of plentiful supplies of lumber as long as our forests are cared for. (See CONIFERS; FORESTS AND FORESTRY; TREES; WOOD.)

LUNGFISH As their name suggests, lungfishes have lungs. They have gills, too, as all fishes have. Because lungfishes have lungs, they can live in water not fit for other fishes. A lungfish simply comes to the surface often to breathe in air.

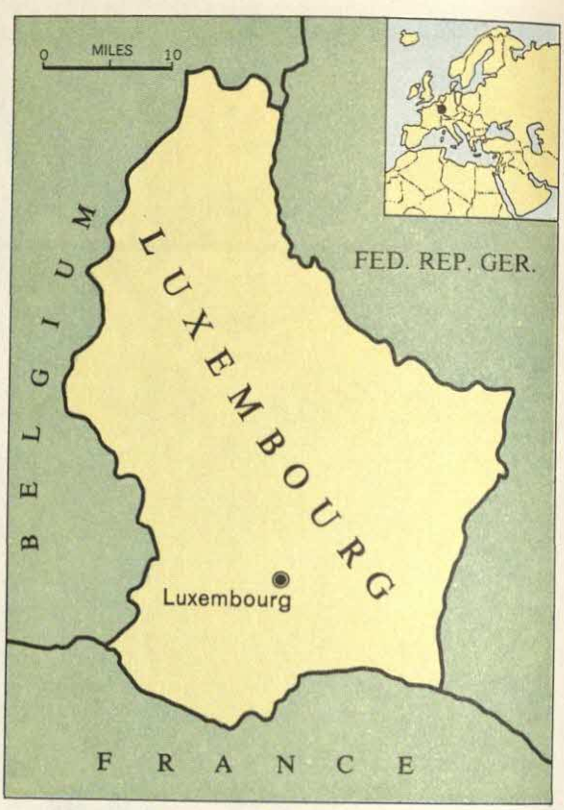
Millions of years ago there were many lungfishes. Today there are only three kinds —one in Africa, one in South America, and one in Australia. The African lungfish is probably the best known. It is often called by another name—the mudfish.

The mudfish is shaped much like an eel. It is usually two or three feet long. Its paired fins are long and slender. They cannot be of any use in swimming. Perhaps they are a help in creeping in mud.

Whenever its water home dries up, the mudfish makes itself a cocoon of mud. It may stay in its ball of mud for several months, getting air through a ceiling "door." When a wet season comes, the fish wriggles out into the water.

A female mudfish lays as many as 5,000 eggs in a cavity at the bottom of the water. The male fish guards the eggs and fans fresh water over them with his tail. The baby fish have featherlike gills on the outside of their bodies. But sooner or later they lose these gills and breathe with inside gills and lungs, like their parents.

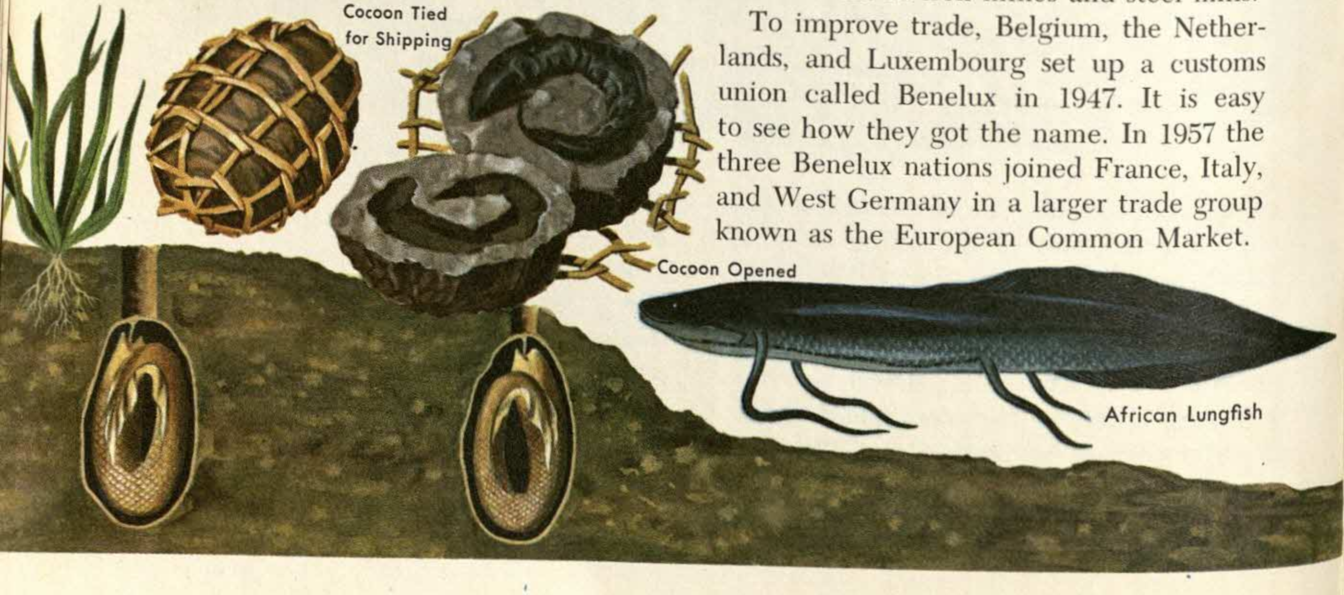
The lungfishes of today are sometimes called living fossils. Knowing that they are the only fish left of a once very large group helps us understand why.



LUXEMBOURG Seven European countries—Vatican City, Monaco, San Marino, Liechtenstein, Malta, Andorra, and Luxembourg—are among the smallest in the world. Luxembourg is the largest of the seven. But even it is smaller than Rhode Island.

Luxembourg is a monarchy ruled by a grand duke. Official languages are German, French, and Luxembourgian. The country uses Belgian money as well as its own. Many of its people farm their own small farms. Others work in iron mines and steel mills.

To improve trade, Belgium, the Netherlands, and Luxembourg set up a customs union called Benelux in 1947. It is easy to see how they got the name. In 1957 the three Benelux nations joined France, Italy, and West Germany in a larger trade group known as the European Common Market.



The letter *M* in its long history has not changed as much as most letters have changed. It began as a picture of wavy water, 〰. The Egyptians used the picture in their hieroglyphic writing. The makers of the first alphabet borrowed it and drew it in much the same way. The Phoenicians added a tail to it, 𐤌. The Greeks changed it a little: Μ. The Romans wrote it just as we write a capital *M* now.

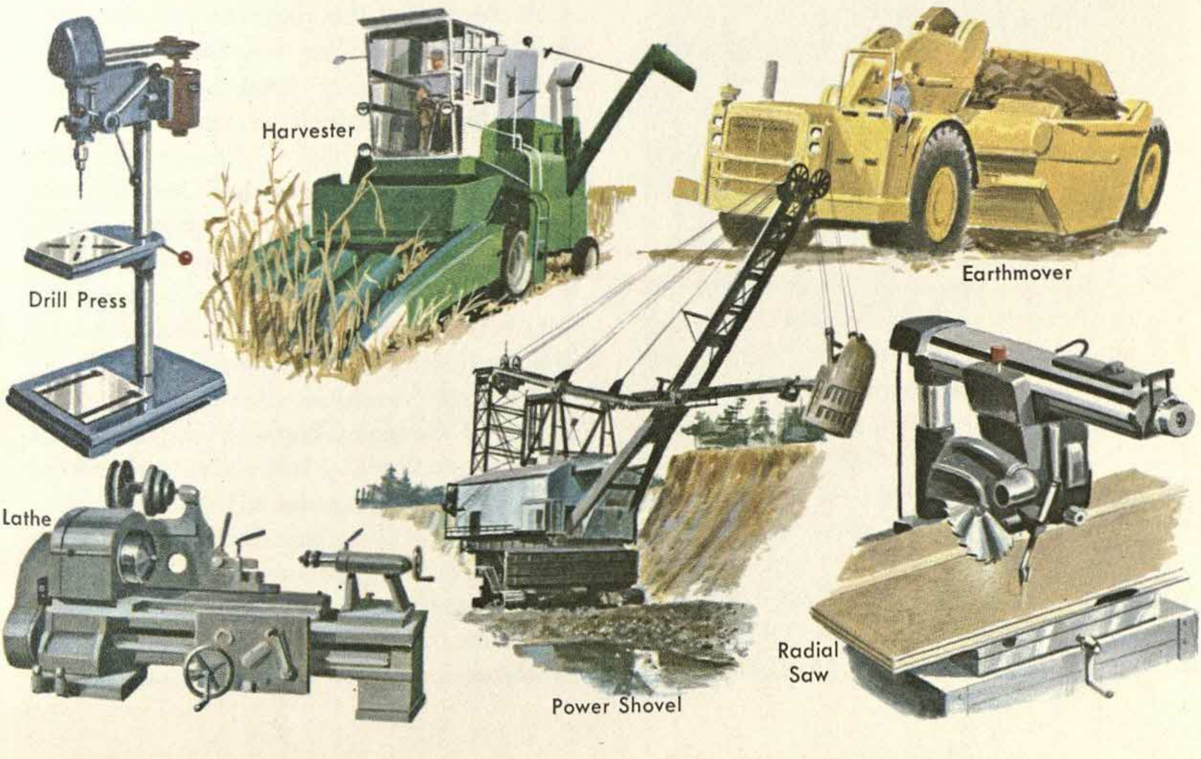
***M* has only one sound, the sound it has had from the beginning. It is a very common sound in English.**

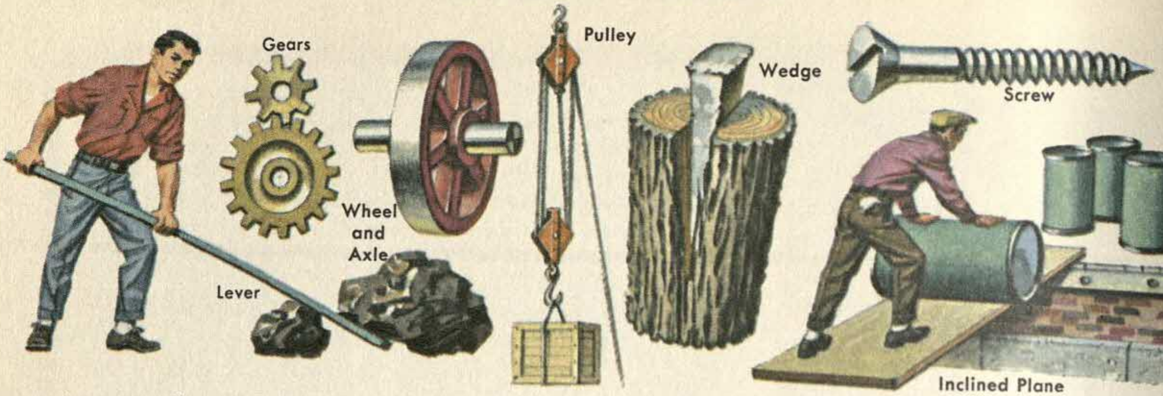
MACHINERY An old house has to be torn down to make room for a new building. A bulldozer is sent for. In a few hours the house is torn down and the waste materials have been carted away. Tearing the house down without a big machine would have taken a man many days or even weeks.

All around us we see machinery at work. On the farm, on our roads and streets, in our factories, and in our homes there are machines by the millions.

Some machines are very powerful. We tell how powerful a machine is by comparing it with a horse. People used horses and other animals to help them with their work long before they had any big machines. A machine that can do 10 times as much work in a certain time as a horse can do is called a 10-horsepower machine. Many automobile manufacturers now advertise engines of more than 300 horsepower.

A machine cannot run all by itself. Energy is needed to make it run. People furnish the energy to run some machines. A boy pedaling a bicycle is furnishing the energy to make the wheels of the bicycle turn. Heat makes many machines run. Gasoline engines, diesel engines, jet and rocket





engines, and most steam engines get the energy they need from the burning of some kind of fuel. Some engines get their energy from the splitting of atoms. Electricity, waterpower, and wind also run machines.

Machinery has made our work much easier. People have more time for rest and play than ever before. Many things that once only the rich could have are now made by machinery so cheaply that almost everyone can have them. Probably machines should get some credit for the fact that people live much longer now than they did 1,000 or 100 or even 50 years ago.

But machines have caused problems, too. Factories rose as power machinery was developed, and people crowded to live near them. Cities grew fast. Many sections near factories became slums.

Some machinery made today works like magic. At the touch of a button whole lineups of machines can be set in motion to carry through all the steps of making and packaging a product. Electronic devices make such automation possible.

Machines can be dangerous. A machine that can knock down a house can easily kill a person. An automobile traveling 100 miles an hour is a danger to everyone on the road. Some people, when they see how many persons are killed in accidents with machines, think that our machines have got a little ahead of us. But certainly no one would want to go back to doing by hand all the work now done by machinery. (See COMPUTERS; ENGINES, HEAT; FACTORY; FUELS; INDUSTRIAL REVOLUTION; VENDING MACHINES.)

MACHINES, SIMPLE The time we are living in is sometimes called the Machine Age. About us we see locomotives, airplanes, automobiles, and other big machines. But people used machines long before such machines as these were invented. A caveman, when he used a small log to pry loose a stone for the door of his cave, was using a machine even though he did not know it. He was using a machine called a lever. When he skinned a cave bear with a sharp piece of flint he was using a machine, too. He was using a wedge.

The lever and the wedge are two of the machines we call simple machines. There are four others. These four others are the inclined plane, the screw, the wheel and axle, and the pulley.

At the top of the page we see these six simple machines. We see, too, how some of them work. The picture also shows gears. A gear wheel is a wheel and axle with a toothed wheel. Our common tools are machines. Some are made up of more than one simple machine. A pair of metal shears, for instance, is made up of two levers and two wedges. The wedges are the cutting edges. In a hand drill a screw is turned by means of a wheel and axle.

Different machines do different jobs. But all of the many kinds of machines help us get work done by letting us trade something for something else.

The man rolling the drum up onto the platform is using an inclined plane. Probably he does not think of the board he has laid from the ground to the platform as a machine, but it is. It is much easier for the man to roll the drum up the inclined plane than it would be to lift it straight up. He does not have to use as much force as he would have to use without the inclined plane. But it takes him more time. For the board is longer than the distance from the ground straight up to the platform. The man is trading speed for force. He can make the work easier still by getting a longer board. With a longer board he will save more force but he will lose more speed.

The man with the lever wants to lift a heavy rock. He uses a lever that will let him move the rock a little way by moving his hand a longer way. Levers can also be arranged so that the worker trades force for speed.

Some machines let us move something in one direction by pulling or pushing in another direction. The lever pictured does. In the same way, the pulley being used to lift a crate lets the crate be moved up by pulling down on the rope. Here, too, speed is traded for force. To move the crate up a foot, the end of the rope must be pulled down four feet. But, if the crate weighs 100 pounds, a force of only about 25 pounds is needed to lift it.

Knowing about simple machines helps us to understand complicated machines. For in every complex machine there is at least one simple machine. (See TOOLS.)

MADAGASCAR The big island of Madagascar—fourth largest in the world—is near the east coast of Africa. For many years Madagascar belonged to France. In 1960 it became the free Malagasy Republic.

A Portuguese explorer, Diogo Dias, discovered Madagascar about 470 years ago. He had sailed around the tip of Africa on his way to India. For a long time after it was discovered the island was a base for pirates, the famous Captain Kidd for one. They sailed out from there to attack boats bringing back rich cargoes from India.

Now Madagascar is a modern land with good roads and many schools. There are thousands of miles of telephone and telegraph lines. About six and a half million people live on the island. Most of them are natives. The natives are an ancient mixture of Africans and Indonesians.

Swamps and dense forests cover most of the lowland near the coasts. The center of the island is a high plateau. Mountain peaks rise from it. The climate of the plateau is pleasant.

Most of the people are farmers or cattlemen. Rice is the chief crop. But there are also many fields of coffee, corn, sugarcane, and manioc. The island is the world's leading producer of vanilla. It also produces each year many tons of cloves. The leading exports are coffee, vanilla, and sugar.

Others of the people of Madagascar work in its mines and forests. The island has graphite, chrome, gold, and gemstones. The forests supply valuable woods.

In the forests of Madagascar there are many strange animals. The tenrec, the fossa, and the aye-aye are three of them. (See AYE-AYE; ISLAND.)

MADONNA A great many early paintings are religious pictures. Many of them are paintings of the Madonna. "Madonna" is the name the Italians gave to Mary, the Mother of Jesus. The paintings of the Madonna show the baby Jesus, too. Some of these paintings are among the most famous pictures in the world. Of them all, probably "The Sistine Madonna" by Raphael is the best known. (See JESUS; RAPHAEL.)

MAGELLAN, FERDINAND (1480-1521) In 1519 Ferdinand Magellan set sail from Spain at the head of a group of five ships. He hoped to reach the East Indies by sailing westward. Columbus had also hoped to do so, but he had been stopped by the Americas. Magellan planned to sail southward and around them.

The trip did not start off well. There were 60 days of rain. The ships sailed southward along the coast of Africa and then crossed the Atlantic. They continued to sail still farther south along the coast of South America. On this part of the voyage one of the ships was lost.

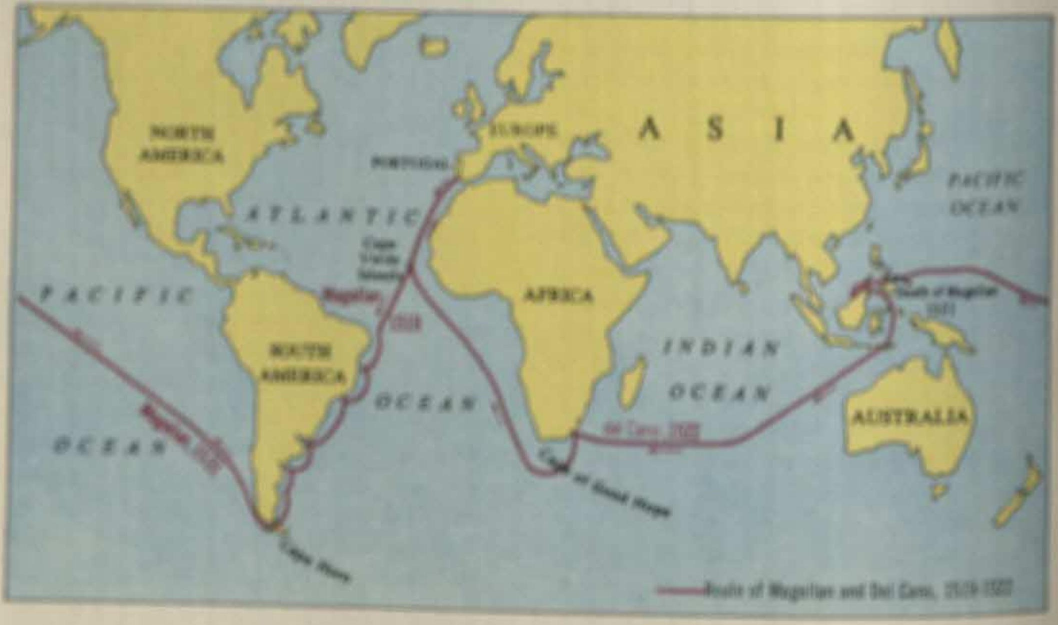
Finally the ships came to a narrow strip of water between high mountains. It was the strait which we now call the Strait of Magellan. The water here was very rough. There were stormy winds. One ship turned back. But the other three went through and reached the Pacific.

Of course, Magellan's ships were sailing vessels. They had to have wind. For days on the Pacific there was none. Food ran short. Water was scarce. But at last the ships reached the Philippines. Here Magellan himself was killed in fighting with the natives. But two of his ships sailed on. Then one of them became unseaworthy.

The last of the five ships—the "Victoria" —picked up a load of cloves in the East Indies and sailed on to Spain. It reached Spain two years and 353 days after it had set sail. Only 18 of the 265 men who had started the trip were left. One was Del Cano, who lead the expedition after Magellan was killed. The "Victoria" was the first ship to sail around the world.

Magellan was a Portuguese. As a boy he was a page in the royal court at Lisbon. There he heard news of interesting happenings in other parts of the world. He was there when Vasco da Gama sailed around Africa to India. He was there when Columbus discovered America, and when Balboa first saw the Pacific. No wonder that he, too, wanted to go exploring.

In his early 30's he reached the East Indies by traveling east. He came back full of plans for reaching these islands by sailing west. But he did not live to find out surely that this could be done. (See CAPE OF GOOD HOPE; CHILE; EAST INDIES; EXPLORERS; HISTORY; INTERNATIONAL DATE LINE.)



MAGIC AND MAGICIANS Almost everyone likes to watch a magic show. A magician seems to do impossible things. He may pull a live rabbit out of a hat that looks empty, make a large birdcage disappear, break his way out of heavy chains, or even appear to saw a person in two. But even children know that all such things are tricks. They are just meant to entertain.

Magic of this kind goes back hundreds of years. In the Middle Ages there were wandering magicians who went from town to town. They gave their shows in city streets or public squares. In more than one city there was a "street of the conjurers." "Conjurer" is another word for "magician." Another name for some magicians is sorcerer.

Many magicians have become famous. Houdini earned fame as an escape artist. With hands bound he could get out of a locked box thrown overboard into water.

To be a good magician a person has to be able to use his hands very well. Some magic is called sleight of hand. "Sleight" means "skill." Magic is also sometimes called legerdemain. This word comes from the French words meaning "light of hand."

A magician must also be able to talk well to his audience. By his talk he keeps them from watching too closely what he is doing.

Even a clever magician cannot put on a good show unless he has many props. Some tricks are done with the help of mirrors. Other tricks require strong magnets. Trick decks of cards, containers with false bottoms, and chemicals that change color are among the other things that magicians use. Some tricks need so much equipment that they must be done on a stage.

Magic is so much fun that many people—grown-ups as well as boys and girls—have chosen it as a hobby. Much equipment for magic acts can be bought. But it is hard to find out how some of the best tricks are done. Successful magicians do not give away the secrets of their best tricks.

Magic has a part in many stories. How much less fun reading would be if there were no magic carpets to fly through the air, no genies to appear, no magic swords to protect their wearers, and no wizards to do impossible things! Storybook magic is not like the magic in a magician's show. It is nothing but make-believe.

Magic is not all fun. It has a serious side. Primitive peoples are great believers in magic. Their magic is part of their religion. With magic they believe that they can fight evil spirits and cast spells on enemies. Medicine men or witch doctors lead them in practicing magic. The men may dress in masks and strange costumes and perform magic dances to frighten evil spirits away. Most of the peoples of the world have outgrown magic of this kind. (See SAVAGES.)

MAGNA CARTA The words *magna carta* are Latin words. They mean "great charter." This charter was an agreement which King John of England made with the English barons in 1215. The charter has a Latin name because it was written in Latin, the language the learned people of Europe used in important writings in those days.

King John wanted to rule exactly as he pleased. He paid no attention to the barons when they complained that he was taking away some of their rights. At last they drew up a charter—a list of the rights they insisted on having—and asked the King to sign it. When King John read the charter, he cried, "Why not ask for my kingdom?" He put the barons off.

Finally the barons marched against the King. On the 15th day of June they met him on the plain of Runnymede. John saw then that he had no choice. He signed the charter. It was so important that it came to be called the Magna Carta.

The Magna Carta was a great step upward for the people of England. It is often called the cornerstone of free government.

These are two of the many rights named in the Magna Carta:

"No freeman can be seized and kept in prison without a fair trial."

"Taxes cannot be decided on by the king alone and collected by force."

The story goes that King John flew into a great rage after he had signed the charter. He tried later to get out of the agreement. But the barons would not let him. And the charter remained in force to remind later rulers that there are laws which even a king may not break. (See ENGLAND'S HISTORY; HISTORY; JUSTICE.)

MAGNETS A magnet fishpond game is a common toy. Each pole has a little magnet at the end. The magnets attract, or pull, iron or steel rings on the fish.

There are many other magnet toys. There are dart games which have painted steel targets and magnet darts. There are airfields on which steel airplanes are moved about by magnets. There are dolls with magnets in their hands, theaters with actors worked by magnets, magnetic blocks, and other magnet toys besides. Just plain magnets are fun to play with.

Magnets have been known for a very long time. The word magnet comes from

Electromagnet

Magnesia, the name of a region in ancient Greece. There, so an old story tells, magnetism was first discovered. One day a Greek shepherd boy rested his iron-tipped shepherd's crook against a rock. When he tried later to move it away, the rock held it tight. No one had ever before found a rock that attracted iron.

The story may not be true. But there is a kind of rock that attracts iron and steel. It is called magnetite or lodestone. Pieces of it are natural magnets.

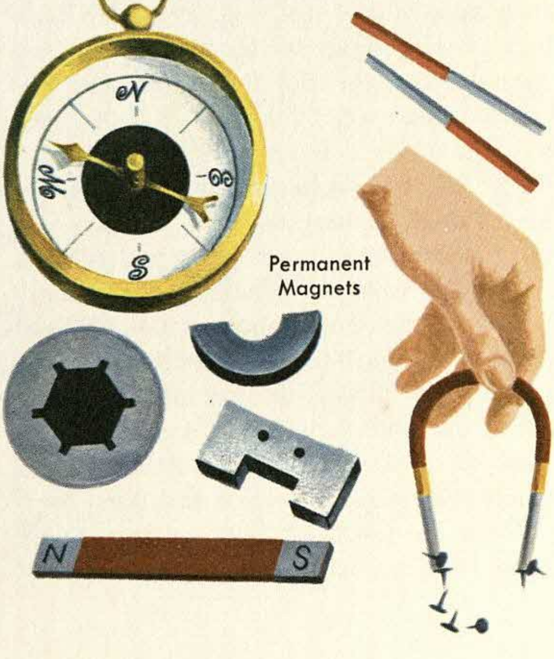
Natural magnets are permanent magnets. "Permanent" means "lasting." The little magnets in a fishpond game are permanent magnets. So are all the magnets in the picture at the bottom of the page. All these magnets are manufactured. Most permanent magnets are far stronger than pieces of lodestone. Permanent magnets are made of steel or of a mixture of steel and other metals.

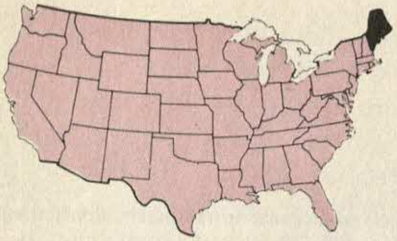
One of the magnets in the picture is marked with an "S" and an "N." The ends of a magnet are called its poles. Every magnet has an S pole and an N pole. When the end of one magnet is brought near the end of another magnet, the ends will attract each other if one is an S pole and the other is an N pole. They will push, or repel, each other if they are both N poles or both S poles. Some magnet toys are based on this behavior of magnets.

Permanent magnets are much more than toys. The needle in a pocket compass is a permanent magnet. Permanent magnets are used in hardware stores to pick up nails. They are used in doctors' offices to remove steel splinters. There are magnetic pens and pencils, ashtrays, refrigerator doors, and letters for display boards. Permanent magnets are built into many machines.

The picture at the top of the page shows a magnet of another kind. An electromagnet does not attract iron and steel unless a current of electricity is flowing through its wires. It will lose its magnetism as soon as the current is shut off. The big electromagnet in the picture is being used to move scrap iron.

Today electromagnets are far more important than permanent magnets. They are a part of many electrical devices. Anyone who went on a magnet hunt in his home would find electromagnets in the doorbell, the telephone receiver, the radio, and the television set. He would find them in the vacuum cleaner, the tape recorder, and all the other devices with electric motors. The big generators that furnish us with electricity have electromagnets in them, too. Life would be very different without electromagnets. (See COMPASS; ELECTRICITY; FARADAY; IRON; NICKEL.)





MAINE The state of Maine lies in the northeastern corner of the United States. The city farthest east in the entire country is Lubec, Me. The state has some 3,000 miles of Atlantic coastline. Although it is small compared with the big states west of the Mississippi, Maine is almost exactly the same size as the five other New England states put together.

Norsemen probably reached the coast of Maine about the year 1000. In 1607 Englishmen attempted to settle near the mouth of the Kennebec River, but cold and other hardships were too much for them. They returned to England. The first permanent settlement was made in 1623 on the Saco River.

For many years the settlers of Maine lived only on the narrow lowland rim that borders the Atlantic. Most of inland Maine is mountainous country. The settlers found it thickly forested and crossed by rivers too rapid for travel.

The colonists built little towns near river mouths and on deep, protected harbors. Their homes were made of logs or lumber from the nearby forests. On the narrow coast the soil was poor. It was hard to make a living by farming alone. Many men turned to the sea. They became shipbuilders, fishermen, and seamen. At the harbors, men built boats and set out on fishing voyages. When they returned, they dried the fish on outdoor tables. They pumped in seawater to make salt for preserving fish. Maine seamen manned whaling ships and fast sailing vessels called clippers that crossed the Atlantic and Pacific to trade in Europe and Asia. Sawmills were built at falls in the rivers. Bangor became a famous lumber city.

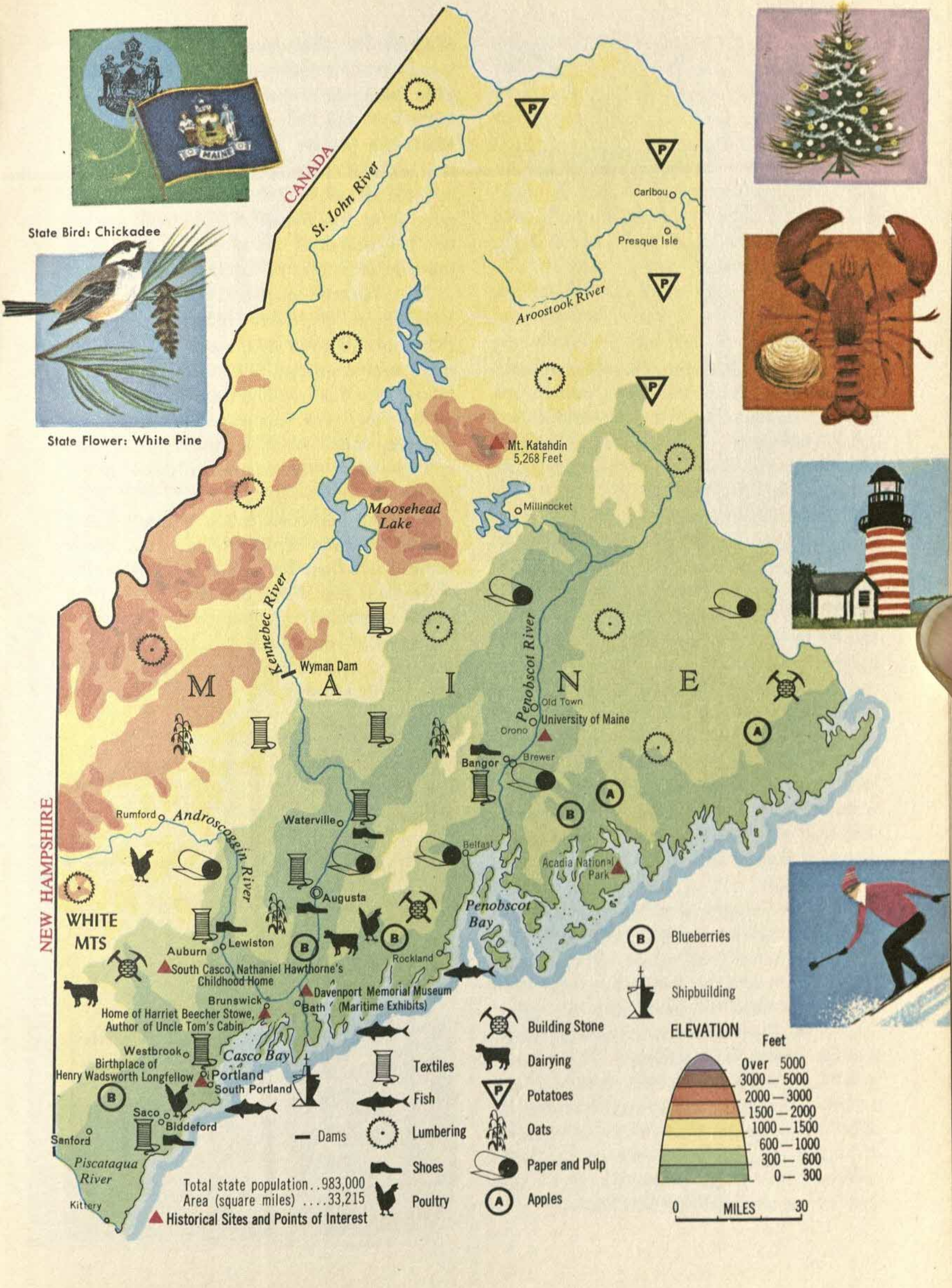
The Maine country was purchased by the colony of Massachusetts in 1677 and remained a part of that state until 1820. Then it became the 23rd state. Augusta is the capital. Maine has prospered but has never become thickly settled.

Today the people of Maine still use both land and sea to make their living. The farmers' most profitable crop is the potato, grown chiefly on the sandy soils of Aroostook County. Maine produces about one-sixth of the country's potatoes. Apples and blueberries are other important crops. Five of every six boxes of blueberries on the market come from Maine. Fishermen bring in choice lobsters, clams, and crabs, as well as cod, halibut, mackerel, and tuna. The lobster catch alone is worth over $10,000,000 a year. Sardine packing, too, is big business.

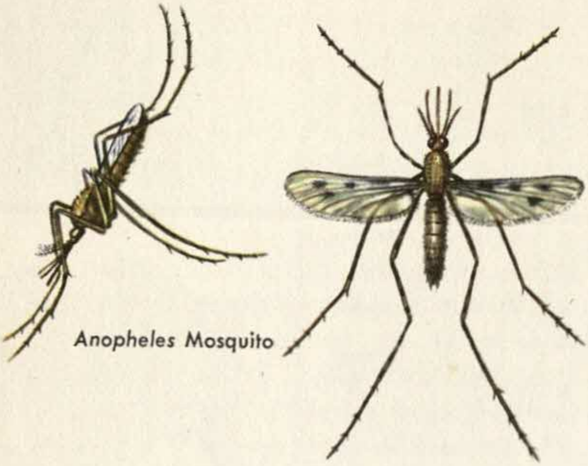
The forest workers provide pulpwood for making paper, the leading manufactured product of Maine. Other goods made from the wood of the forests include such things as checkers, spools, dowel rods, skis, and toothpicks. The state produces more than 100,000,000 toothpicks a day! Much wood goes into lumber. At Bath, Kittery, and South Portland shipbuilders build fishing, cargo, and pleasure boats. The chief seaport and largest city is Portland.

Maine is a beautiful vacationland. One of the most profitable businesses today is "entertaining the paying guest." The number of people in the state doubles in the summers, which are pleasantly cool. There are many camps for boys and girls and many vacation resorts. Maine still has large conifer forests. Its nickname, the "Pine Tree State," is fitting. It has fine beaches, deep harbors, rocky headlands, inland lakes, and offshore islands. Mount Desert is one of these islands. Acadia National Park on this island is the oldest national park east of the Mississippi.

The state song is "State of Maine." *Dirigo*, the state motto, is a Latin word meaning "I direct."



Total state population . . 983,000
Area (square miles) 33,215



Anopheles Mosquito

MALARIA Of all the many diseases, malaria has long been one of the most common. As late as 1955 there were in the world about 250,000,000 cases a year and about 2,500,000 people died of it. Now fortunately there are far fewer cases and deaths.

People with this disease have chills and very high fever. Malaria is most common in hot, wet tropical lands. But it is also found in swampy regions outside the tropics.

It used to be thought that the disease was caused by the air from swamps. Now we know that malaria is caused by certain protozoa—one-celled organisms—known as the malaria parasite.

Malaria is carried from one person to another by the *Anopheles* mosquito. A mosquito bites a person with malaria and sucks in some blood. The blood has malaria parasites in it. When the mosquito bites another person it may leave some malaria parasites in the wound.

For a long, long time the only good medicine for malaria was quinine. During World War II quinine was scarce. Since many soldiers were fighting where there was much malaria, scientists began hunting for other medicines. They succeeded in making some that are better than quinine.

Without mosquitoes there could be no malaria. The great drop in the number of cases of malaria is due chiefly to modern ways of getting rid of mosquitoes. (See DISEASE GERMS; MOSQUITOES; PANAMA CANAL; PARASITES; PROTOZOA.)

MALAYSIA The country of Malaysia is young—it did not come into being until 1963. Malaysia is made up of Malaya (West Malaysia) and Sabah and Sarawak (East Malaysia). Malaya fills the southern end of the Malay Peninsula in southeastern Asia, but it does not include the island of Singapore at its tip. Sabah and Sarawak are on the big island of Borneo. The capital is the handsome city of Kuala Lumpur.

The country's population of 10,000,000 is made up of Malays, Chinese, Indians, Pakistanis, Dayaks and many other rather small native groups, and some Europeans. Many different languages are in use.

This hot, rainy country is close to the equator. Much of it is mountainous and still covered with dense tropical forest where few people live.

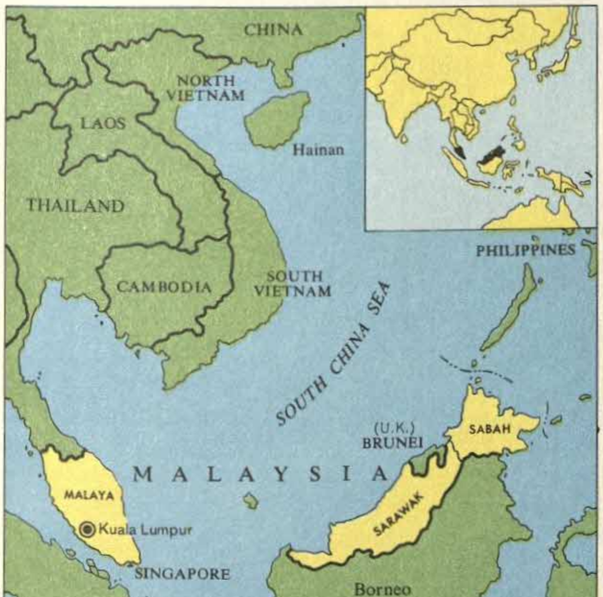
Malaysia has been called a land of tin, trees, and trade. From Malaya's tin mines comes more than 700 million dollars' worth of tin each year. From Sabah's forests come huge amounts of valuable timber. The rubber trees of rubber plantations throughout Malaysia produce more than a billion dollars' worth of rubber yearly. And oil palms

yield large quantities of palm oil. One of the world's great shipping lanes runs along the west coast of Malaya and links the country with western Europe and the United States, both big buyers of what Malaysia has for sale. The busy port of Singapore at Malaya's doorstep links Malaysia with Hong Kong and Japan.

Tin, trees, and trade, however, do not tell the whole story of the work of Malaysia's people. Other important exports are iron ore from Malaya and pepper from Sarawak. Rice is the main farm crop, but the country needs all its rice.

There are few factories in Malaysia. It must import machinery for use in the mines and on the rubber plantations, cars and motorcycles, textiles, and chemicals.

The different parts of Malaysia are connected by plane, as well as by ship, with other lands. And there are thousands of radios and TV sets to keep this new country in touch with the rest of the world.



MAMMALS About 4,500 kinds of animals belong to the big group of animals we call mammals. In this big group are many of the animals we have tamed, among them horses, cattle, dogs, cats, sheep, goats, pigs, donkeys, camels, rabbits, and guinea pigs. Many of the wild animals that we keep in zoos are mammals. We are ourselves.

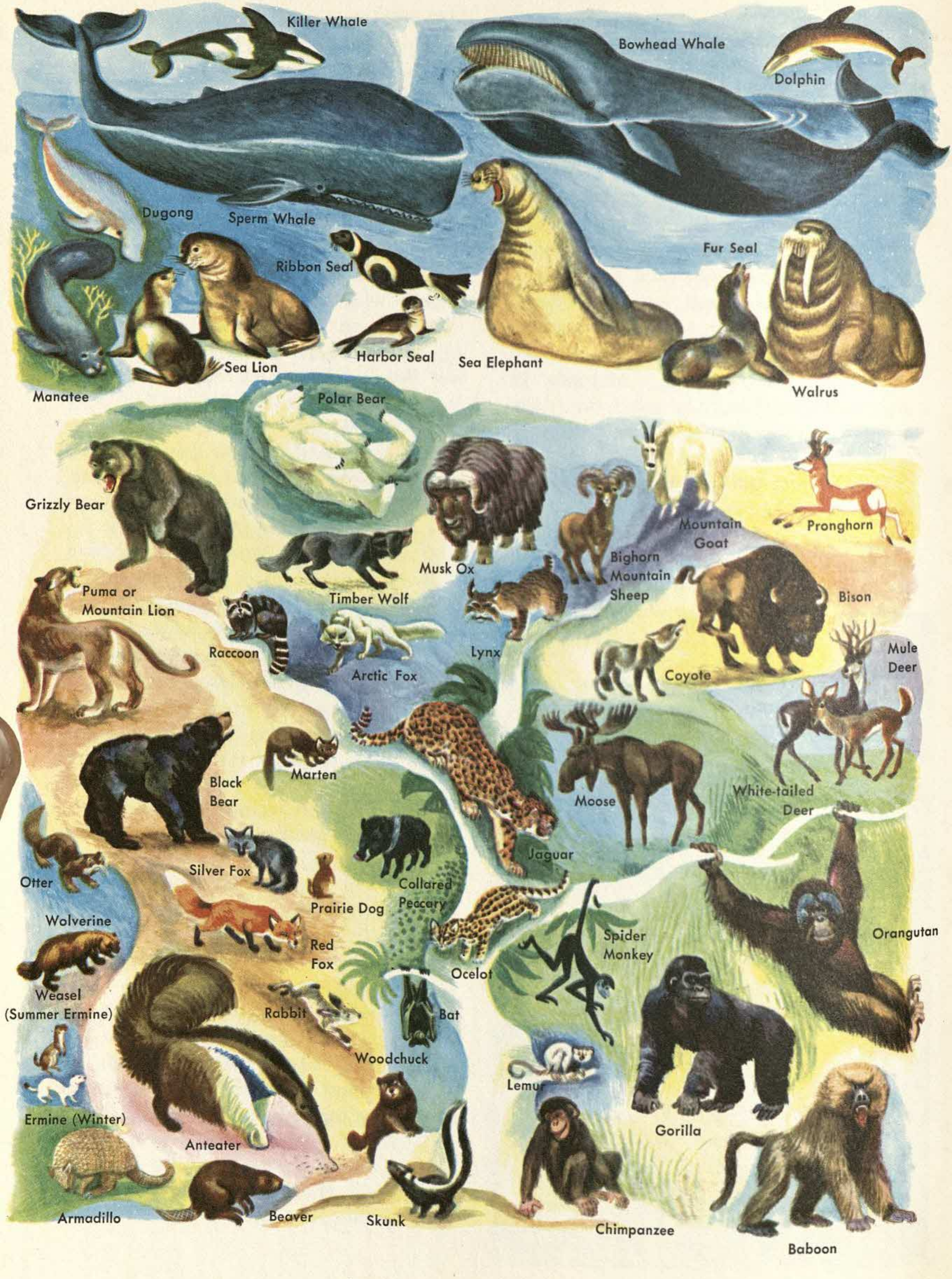
All mammals have skeletons of bone. In this way they are like the birds, reptiles, amphibians, and bony fishes. All mammals breathe with lungs all their lives. In this way they are like the birds and reptiles. All mammals are warm-blooded. In this way they are like the birds. All mammals feed their babies with milk from their own bodies. In this way they are different from all other animals. Another way in which they are different is that they have hair. Some, like the elephant and the whale, have only a little. But they all have some.

All mammals are big enough to be seen easily. But some are much, much bigger than others. A pygmy shrew weighs only about as much as a penny. A blue whale weighs many tons. So far as anyone knows, the blue whale is the biggest animal that ever lived. It is even bigger than the giant dinosaurs of long ago. Think of a shrew and a whale playing teeter-totter!

The whale lives in water. So does the manatee. The seal, walrus, otter, and a number of other mammals spend much of the time in water. But most mammals are land animals. On land they live in all sorts of places: in deserts, prairies, forests, and marshes; on the ground, under the ground, and above the ground; in hot lands, cold lands, and in-between lands.

Bats can fly. Flying squirrels and a few others can glide. People walk on two legs. Some other mammals also move on two legs. But most mammals have four legs on which they run, scamper, walk, or climb.

Two kinds of mammals lay eggs. They are the duckbill and the spiny anteater, or echidna. The babies of all other mammals are borne by the mother. After baby


Killer Whale
Bowhead Whale
Dolphin
Dugong
Sperm Whale
Ribbon Seal
Fur Seal
Sea Lion
Harbor Seal
Sea Elephant
Manatee
Walrus
Polar Bear
Grizzly Bear
Musk Ox
Mountain Goat
Pronghorn
Bighorn Mountain Sheep
Timber Wolf
Puma or Mountain Lion
Bison
Raccoon
Arctic Fox
Lynx
Coyote
Mule Deer
Marten
Black Bear
Moose
White-tailed Deer
Jaguar
Otter
Silver Fox
Collared Peccary
Prairie Dog
Wolverine
Red Fox
Spider Monkey
Orangutan
Ocelot
Weasel (Summer Ermine)
Rabbit
Bat
Woodchuck
Lemur
Ermine (Winter)
Gorilla
Anteater
Armadillo
Beaver
Skunk
Chimpanzee
Baboon

duckbills and spiny anteaters hatch, their mothers feed them with milk just as other mammal mothers feed their babies.

Some mammals have only one baby at a time. Some have several. Not a single one has hundreds or thousands, as such animals as fishes and frogs do. But mammals can hold their own because their babies are well taken care of.

As the chart below shows, the big group of mammals has been divided up into smaller groups. Some of these groups have many more kinds of mammals in them than others. The aardvark is the only mammal in its group. So is the little coney, or hyrax. In the duckbill group there is only one other animal—the spiny anteater. On the other hand, some of the groups have hundreds of kinds of mammals in them.

The carnivores are one of the big groups. The name "carnivore" means "meat eater." Not all the mammals that eat other animals are in this group. The great anteater, for instance, is not. And a few mammals—the giant panda for one—in the group have given up their meat-eating habit. But on the whole the name is a good one. Nearly half of all the mammals shown in the picture on the opposite page are carnivores. Among them are the sea lion, jaguar, marten, wolf, skunk, raccoon, and weasel.

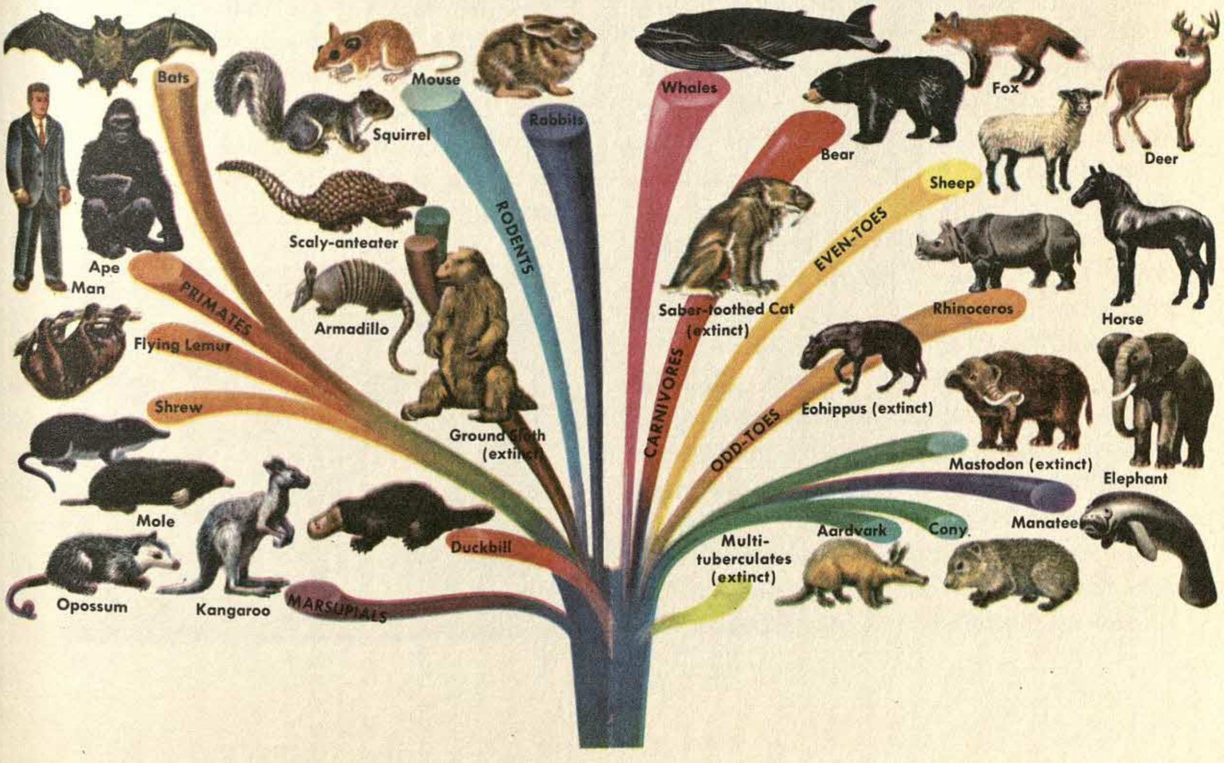
Those called even-toes are hoofed mammals with an even number of toes. This is another large group. The pronghorn, bison, mountain goat, musk-ox, and peccary, as well as the sheep and deer, belong here. So do the camel, giraffe, hippopotamus, and all the many antelopes. The even-toes all eat plants.

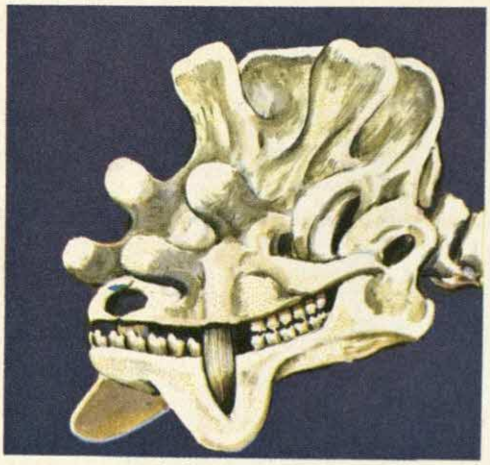
The odd-toes group is small. In it are the horse, rhinoceros, zebra, donkey, and tapir. They, too, are all plant eaters.

The rodents make up a very large and successful group. They are the gnawing mammals. Rodents are able to live in all sorts of places. The beaver and the woodchuck are among the larger rodents.

The primates include all the monkeys, lemurs, and apes. This is the group of mammals to which human beings belong.

Much of our meat comes from mammals. All our milk, of course, and all the fur we use comes from them, too. Many of our pets are mammals and so are all our work animals. This group would be very important even if it were not the one we ourselves are in. (See ANIMAL KINGDOM; HOOFED ANIMALS; MAMMALS OF YESTERDAY.)





Skull of *Uintatherium*

MAMMALS OF YESTERDAY Most of the animals in zoos are mammals. But no zoo in the world has in it the mammals in the pictures on these two pages. There is a very good reason why. These mammals disappeared long ago. They are all, as scientists say, extinct.

Although all these mammals are animals of the past, they did not all live at the same time. Of those in the pictures, *Uintatherium* and *Andrewsarchus* are the most ancient. They lived some 40 million years ago, not many millions of years after the last of the dinosaurs disappeared.

Uintatherium means "Uinta beast." The Uinta beast gets its name from the Uinta Mountains in Utah, where skulls like the one in the picture at the top of this page and other fossils of this big creature are found. *Uintatherium* was the giant of its time—it was about the size of an African elephant. As you see, it specialized in horns. It had three pairs at various places on its homely face. This ancient mammal must have been rather stupid. It had a very small brain.

Uintatherium ate only plants. No one is sure what wolflike *Andrewsarchus* ate. Perhaps it lived on shellfish or dead animals. The skull of this creature was more than a yard long.

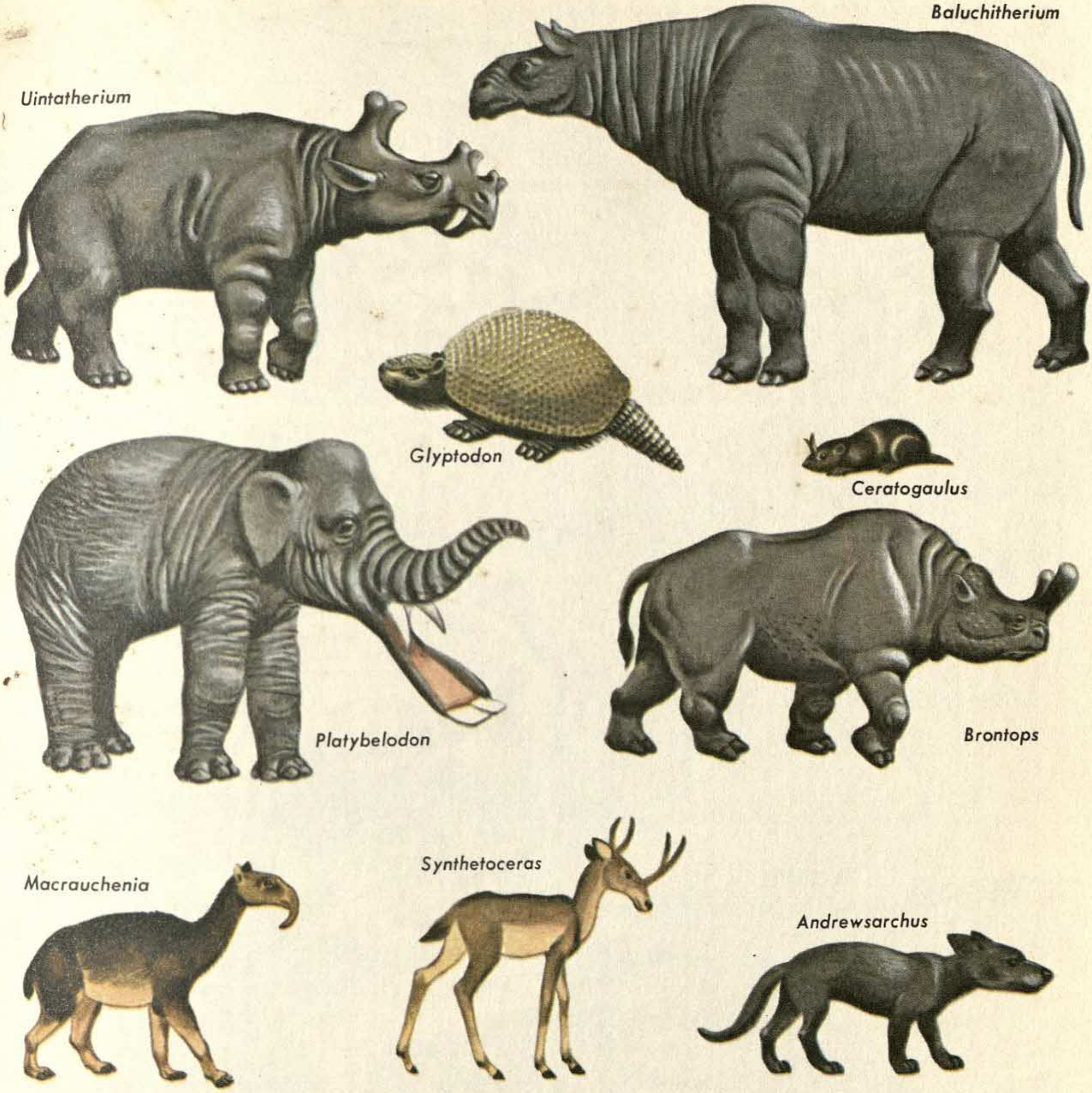
Brontops and *Baluchitherium* lived some ten million years later. *Brontops* was one of the titanotheres, or "giant beasts." It grew to be 8 feet high at the shoulders and 15 feet long. Like the Uinta beast, it specialized in horns, but it had only one pair, just back of its nose. They were, however, extremely large. (Its name means "thunder face.") As you can guess from its dish-shaped skull, *Brontops* was not the brainiest of animals. *Baluchitherium* was a giant hornless rhinoceros. Eighteen feet tall and 27 feet long, it was the largest *land* mammal of all time. But it was by no means as large as the biggest mammals—the giant whales—or the biggest dinosaurs.

Ceratogaulus was a gopher of some 15 million years ago. Unlike any rodent of today, this ancient rodent had horns. No one knows what purpose, if any, they served.

Platybelodon, the shovel-tusked mastodon, lived only a few million years ago. Its big lower jaw ending in two flat tusks made an excellent shovel for scooping up plant food. *Synthetoceras* was a deerlike animal that lived at the same time. In addition to two horns in the customary places, this animal had, just above its nostrils, a grotesquely long pair of horns that were joined together at the base.

The other three animals pictured are all Ice Age mammals. From its shape and its trunk you might guess that *Macrauchenia* was a cross between a camel and an elephant. But it was not closely related to either. *Glyptodon* was a giant armored mammal related to the armadillos of today. The sabertooth is sometimes called the sabertooth tiger. It was not a tiger. But it did

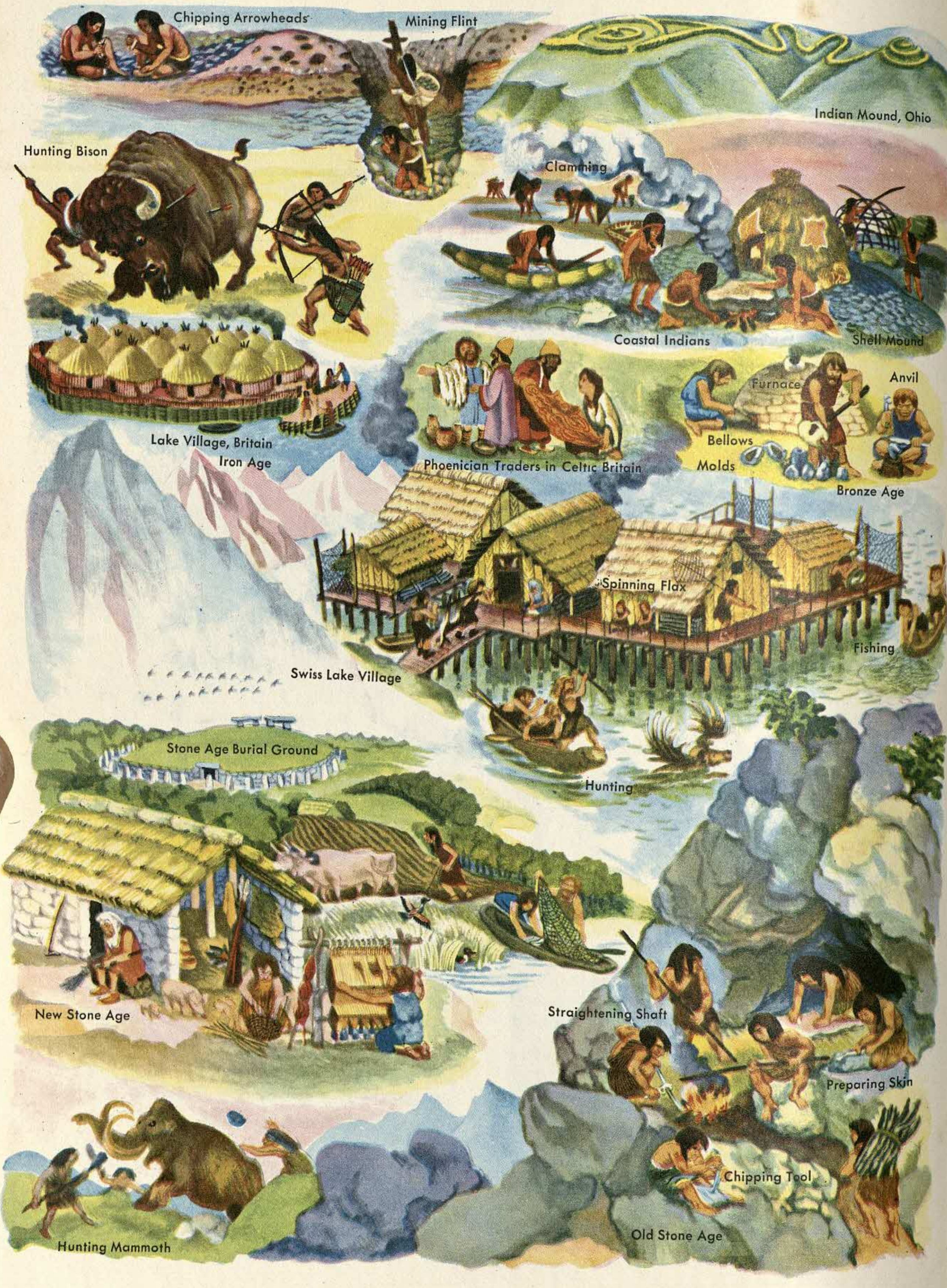
Sabertooth



belong to the cat family just as the tiger does. It got the name sabertooth from its two long fangs that were as sharp as swords, or sabers. Like all cats, the sabertooth was a meat eater. With its long, sharp teeth it could slash through the thick skins of even the great mammoths and mastodons that lived when it did.

Some of the mammals of yesterday lived in the sea. One was *Zeuglodon*, an ancient whale. It did not look at all like the big whales of today. Although it was very long—70 feet or so—it was also very slender, much like the great sea serpents of early sailors' tales.

Many, many other mammals have come and gone. In many cases why they disappeared is puzzling. Probably changes in their surroundings were largely to blame. Other mammals that fitted the new conditions better doubtless crowded them out. (See ADAPTATION TO ENVIRONMENT; BIRDS OF YESTERDAY; DINOSAURS; FOSSILS; ICE AGE; LIFE THROUGH THE AGES.)


Chipping Arrowheads
Mining Flint
Indian Mound, Ohio
Hunting Bison
Clamming
Coastal Indians
Shell Mound
Lake Village, Britain
Iron Age
Phoenician Traders in Celtic Britain
Furnace
Anvil
Bellows
Molds
Bronze Age
Spinning Flax
Fishing
Swiss Lake Village
Stone Age Burial Ground
Hunting
New Stone Age
Straightening Shaft
Preparing Skin
Chipping Tool
Hunting Mammoth
Old Stone Age

MAN Half a billion years ago the trilobites were the earth's leading animals. Later there was a long, long time when fishes were at the top of the animal world. Still later, reptiles were the lords of the earth. In time they were pushed aside by mammals. Now we are in the Age of Man. Man is at the top of the animal kingdom. ("Man" here means mankind, or human beings. It means women and children as well as men.)

Man is a mammal. He belongs to the group of mammals called primates. His closest relatives in the animal kingdom are the manlike apes—the gorilla, chimpanzee, gibbon, and orangutan. But he is different in some very, very important ways from these relatives of his.

Every living thing scientists know about has a scientific name. The name is always in Latin. The scientific name for human beings of today is *Homo sapiens*. *Homo* is the Latin word for man. *Sapiens* is the Latin word for thinking.

No one knows exactly when or where the first people appeared on the earth. The earliest we can be sure of lived about 1,000,000 years ago. And there is some evidence that modern man—*Homo sapiens*—has been here for at least 200,000 years. Man, then, is a creature of the Ice Age.

When we think of some of the other Ice Age animals, it seems rather surprising that human beings were able to hold their own. They were not nearly as large as the mammoths and mastodons. They were not nearly as strong as the cave bears. They could not run nearly as fast as horses and deer. They had no built-in weapons like the sharp fangs of the sabertooth.

But early people did have some big advantages. They had better brains than any other animals. They had good hands—hands with thumbs that helped in grasping things. They could walk upright so that their hands were free for use. And they had eyes that looked in the same direction so that they had a two-eyed view of what they saw. With their better brains they could invent ways of helping themselves. With their good hands, helped by their good eyes, they could carry out their plans. With their brains they also worked out ways of talking to one another. We know of no other animals with such a language.

Being able to talk to one another made it possible for people to work together. In time they learned to divide up the work to be done. Only a few other kinds of animals have ever developed ways of working together and dividing up the jobs. Among them are ants, termites, and honeybees.

For a very, very long time people could not write. Writing, in fact, is only a few thousand years old. There are, therefore, no written records of early man. We can tell about very early people only from their skeletons and from such things as their tools and the bones of animals they killed.

The earliest people we know much about we call Neanderthal man. Neanderthal man was scattered over three continents—Europe, Asia, and Africa. For many thousands of years some of them lived in caves in southern Europe. They lived in the time we call the Old Stone Age. Their tools and weapons were all made of stone.

The story of man from the time he first appeared to the time he learned to write is the story of a long climb. Important steps in it were these:

Learning to use fire and cook food.
Learning to make pottery.
Domesticating plants and animals.
Learning to use metals.
Inventing simple tools.
Learning to spin and weave.

Will people be pushed aside in a few million years just as the ancient reptiles we call dinosaurs were? No one, of course, has any way of knowing. But, with the great strides being made today toward understanding and controlling the world around us, it certainly looks as though we may be here to stay. (See CAVE DWELLERS; ICE AGE; NEANDERTHAL MAN; RACES OF MANKIND.)

The manatee is sometimes called the sea cow.

MANATEE The mermaids the people of long ago told of seeing may well have been manatees. A mermaid was supposed to be half maiden and half fish. All mermaids, the stories of them said, were beautiful. But a manatee certainly is not.

The idea of mermaids may have come from seeing this big animal at a distance floating upright half out of the water, perhaps with a baby clasped in one of its flippers. The manatee is a mammal that lives in water. Like all other mammals, it breathes air. As a rule it comes up for air every 10 or 15 minutes.

A female manatee usually has only one baby at a time. Like any other mother mammal, she feeds the baby milk from her own body. She holds it in her flippers under the water as it nurses. Sometimes a mother manatee is seen with two babies. She may be "baby-sitting" for another mother that has gone browsing for food.

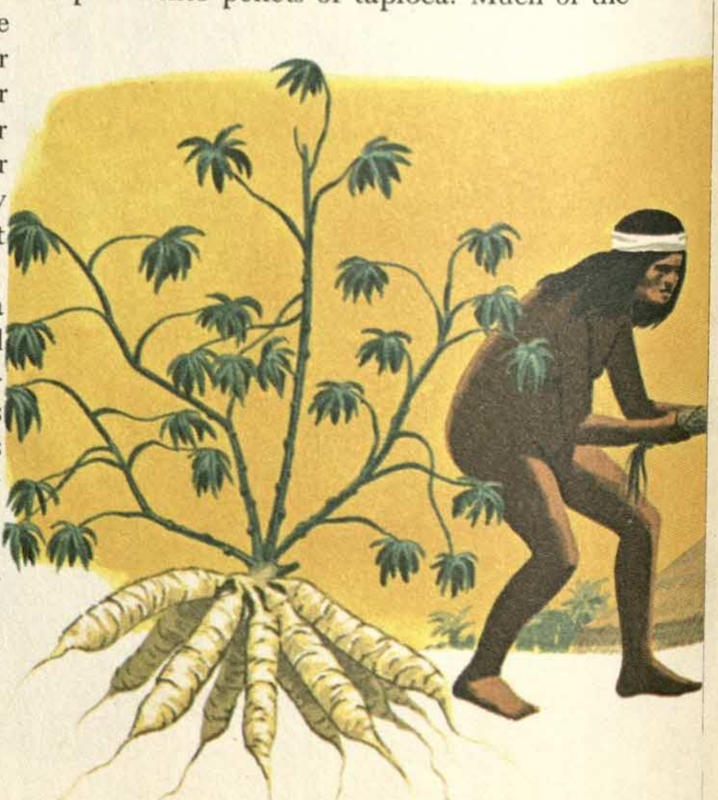
Another name for the manatee is sea cow. This name suggests that the animal is big and slow-moving, and it is. A full-grown manatee may weigh three-quarters of a ton. At night a manatee sometimes makes a sound much like the sound a cow makes when it needs to be milked. The dugong, a close relative of the manatee, is also a sea cow. In the early writings of India, sea cows are called "milk-giving fish."

Manatees are found along the shores of warm seas. In the United States they are found on the Florida coast. They eat plants that grow in the shallow water. Their thick upper lip is divided in two. With it they tear off parts of plants. They use their flippers to stuff their food into their mouths.

The manatee has no good way of protecting itself. To try to save it, Florida has laws safeguarding the manatees along her coasts. (See MAMMALS; MERMAID.)

MANIOC Tapioca pudding is a dessert that many people like. The tapioca for it comes in tiny grains or balls. They are mostly starch. Tapioca is made from the roots of a plant called manioc. Another name for manioc is cassava. The plant is a bush that grows to be about ten feet high. It is raised chiefly in the hot, wet lowlands along the Amazon River in South America and the Congo River in Africa.

The two-foot-long roots of manioc are the shape of sweet potatoes. In making food from them the roots are cleaned and peeled. They are next grated into pulp and their bitter juice is squeezed out. To make tapioca, water is run through the pulp. It takes out the starch, which is rolled on hot plates into pellets of tapioca. Much of the

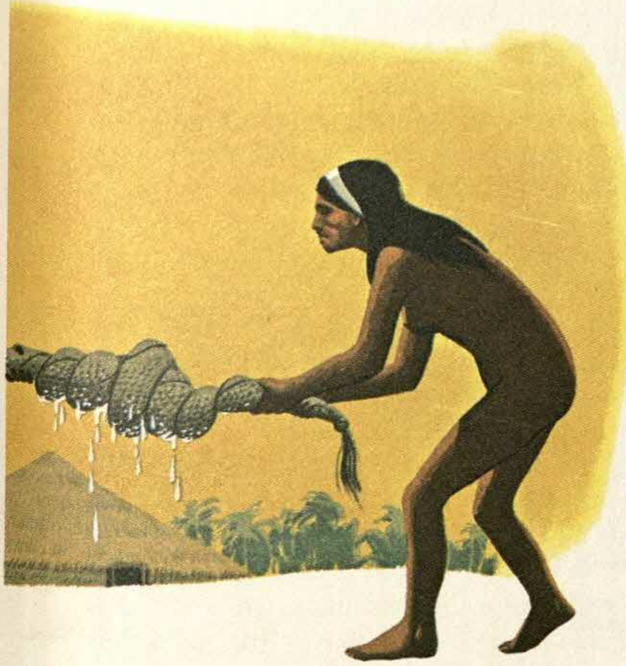


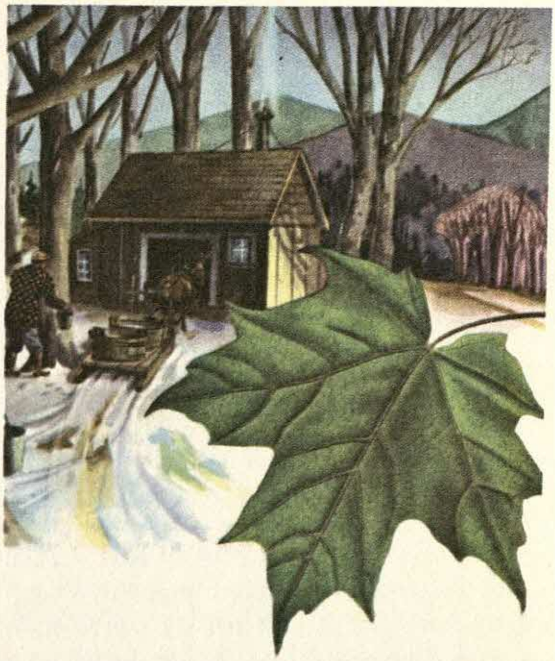
manioc raised goes into meal instead. The pulp is simply dried. Usually the meal is pounded into flour and is baked in the form of giant pancakes.

Manioc is such an important food in the Amazon region that it is sometimes called the "bread of the Amazon." The roots must not be eaten as they come from the ground. They have in them a very poisonous acid. Fortunately, heat drives out the poison.

Manioc plants are easy to raise. A new plant will grow just from a piece of stem.

MAPLE SUGAR During the warm, sunny months of summer, the leaves of sugar maple trees produce a large amount of sugar. They make it out of water and carbon dioxide, just as all green plants do. Much of this sugar the maple trees use up at once, for, like all living things, they need food. But some of it they store in their trunks. It stays there during the winter. In late winter or early spring, when a thaw follows a period of freezing, water with some of the stored sugar dissolved in it comes out through any cut made in a tree's trunk. From this "sap," maple sugar and maple syrup are made.

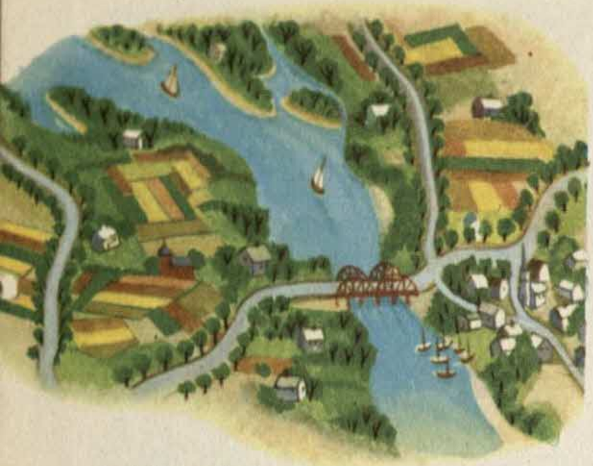




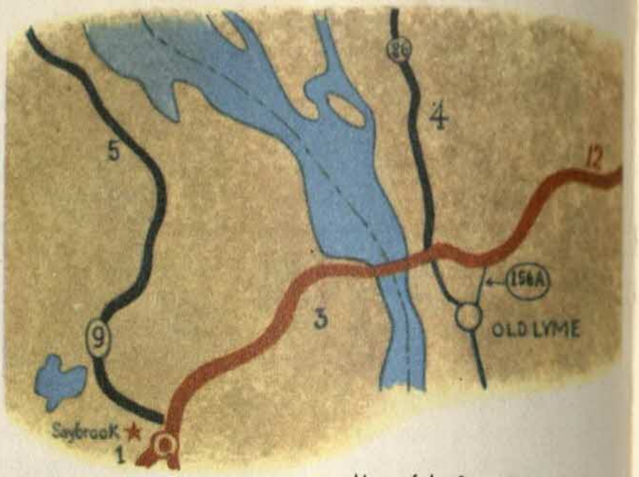
When people first began making maple sugar, they chopped a big piece out of the trunk of each tree to make a hollow to catch the sap. Doing so did a great deal of harm to the tree. Later, to avoid damaging the trees, only small holes were bored in the trunks. A spout was driven into each hole, and from it a bucket was hung. The buckets were carefully watched, and the sap was collected from them. Now, as a rule, plastic tubes carry the sap directly from the holes to storage tanks.

The sap is strained and then heated. As it is heated, water evaporates from it and it gets thicker and thicker. When it is rather thick, it may be used for maple syrup. The syrup must be bottled quickly or it may spoil. If maple sugar is wanted, the syrup is heated still more. At last the sap is so thick that when it is allowed to cool it hardens into solid cakes of maple sugar. Candies and ice-cream toppings may be made from the sugar or syrup.

Making maple syrup and maple sugar is an important kind of work in Canada and some areas of the United States. Vermont, New York, and Ohio are three of the states which produce maple sugar. (See LEAVES; PLANT FACTORIES; SUGAR; TREES.)



Aerial View of a Town



Map of the Same Town

MAPS The picture above shows a small part of the earth's surface as it would look if you saw it from an airplane. Beside the picture there is a map of the same small part of the earth with a little territory added at the left. The map does not show the fields and trees and farmhouses. It does not show the houses in the town on the riverbank. There is merely a circle to stand for the town. The map shows the river and the islands in it, but it does not show the boats on the river, or the kind of bridge that crosses it. The map does, however, show some things the picture does not show. One road is colored red, telling that it is a main highway. The roads, moreover, are numbered, and distances along the roads are marked.

Early explorers had to sail unmapped seas.

Maps are drawings that show how such things as coasts, rivers, towns, and mountains are arranged on the earth's surface. Special signs on maps tell about directions and distances. Like the simple map above, many maps are drawings of a very small part of the earth. But some maps show the whole earth.

A ball on which the map of the earth has been drawn is called a globe. The globe on the next page helps us see how the real earth ball looks from far enough out in space to see it as a ball. From the globe in the picture we can see how North America, South America, Europe, and Africa border the Atlantic Ocean. When the real earth is viewed from out in space, there are, of course, no direction lines such as the equator on it. And much of the surface is hidden by snow-white clouds.

A globe is better than any flat map for showing how oceans and continents are arranged on the earth's surface. In the flat map pictured with the globe the oceans and continents have had to be stretched badly out of shape at the north and south.

Every flat map or globe is drawn on a certain scale—a certain distance on the map, that is, stands for a certain distance on the earth. The map of Maine in this volume is far bigger than huge Africa on the globe on the next page. On the map of Maine an inch stands for a little more than

30 miles. On the globe an inch stands for about 4,000 miles. From the size of their maps in this volume one might think that Maine is much larger than Malaysia, but the two maps are made on different scales.

The map of Chicago in this encyclopedia is drawn on a still larger scale than the map of Maine. In the map of Chicago an inch stands for only four miles.

It would not be helpful to make a globe on the scale of the Chicago map. On the scale of four miles to an inch, a globe would stand as high as a 12-story building. South America on such a globe would measure 100 feet from north to south!

Some of the many maps in this encyclopedia are much more complicated than the little map on the opposite page. On the map of Maine, for instance, we can see how the coast, harbors, rivers, lakes, and cities are arranged. Colors tell us how high the land is in all parts of the state. Signs show us the chief ways in which the people of the state make a living. Other signs tell us where there are especially interesting sights. This map of Maine helps us see in imagination what we would really see if we were to take a trip to Maine.

There are several other kinds of maps in the encyclopedia. Some tell about population, some about rainfall, some about temperature, some about vegetation, and some about other things. But the encyclopedia has examples of only a few of the hundreds of kinds of maps mapmakers make. Different plans for showing the earth's curved surface on flat paper are called projections. There are many projections. Today in the great map libraries there are collections of thousands of maps showing different things and drawn on different scales and projections.

The story of maps begins long ago. But until modern times people could not have maps like those we use now. Before such maps could be made men had to invent the telescope, camera, and instruments for finding out about directions and distances. They had to explore thousands of places and make thousands of measurements. Before modern times all travel was slow. It took men centuries to find out what maps now tell us about our world. The whole story of exploration and discovery has been called "unrolling the map."

There still is much more which men need to discover and to tell about on maps. Many countries keep hundreds of people busy doing the work which must be done in order to make even better maps than those we now have. Mapmakers have been helped in recent years by pictures taken from satellites.

The story of the many ways in which maps are used today is much too long to tell here. Both in wartime and peacetime maps are very important in the work of the world. (See EXPLORERS; GEOGRAPHY; LATITUDE AND LONGITUDE; SATELLITES; U.S. WEATHER BUREAU.)

MARBLES The game of marbles is one of the oldest of all games. It may even have been played back in the days of the cavemen. At least many smooth, round pebbles have been found with other relics of the cavemen. We know that Egyptian boys played marbles several thousand years ago. It was a common game in ancient Rome. It was well known, too, in Europe during the Middle Ages. Now it is played far and wide over the world. In the United States a game of marbles is one of the signs of spring. The game consists in shooting marbles out of a ring with other marbles. Another name for it is ringer.

Marbles are made of different materials. Some, but not many, are made of real marble. "Glassies" are made of glass. "Aggies" are made of agate. Other marbles are made of carnelian, onyx, baked clay, steel, and plastics. Some marbles are especially made to be shooters. Shooters are sometimes called "taws." The playing marbles are "migs" or "mibs."

There are rules for playing marbles just as there are for other games. But the same rules are not followed everywhere.

In the United States there is a national marble tournament every year. Boys travel to it from all parts of the country. Any American boy would be proud to win this tournament. (See GAMES AND SPORTS.)

MARCO POLO (1254-1324) Seven hundred years ago Venice was a great center of trade. Her merchants traveled far and wide to buy and sell.

In 1265 two of her merchants had journeyed far into Asia. They had gone beyond the Caspian Sea. These merchants were brothers—Niccolo and Matteo Polo. As they turned toward home they met an ambassador on his way to the court of the great Kublai Khan. Kublai Khan was the ruler of a very large part of Asia. His court was in a city of Cathay, the land we now call China. The Polos decided that they, too, would go to Cathay.

Marco Polo in Cathay

It took them a year to reach the court of Kublai Khan. There they were well treated. When, after a few years, the Polos started back to Venice, the Khan invited them to return. He hoped they would bring teachers with them when they came again.

Not many years before the Polos had first left Venice, Niccolo's son Marco had been born. He was 15 years old when his father and uncle came home.

Two years later the brothers were on their way to China again. This time Marco was with them. No one in history had more exciting adventures than Marco Polo had in the next 25 years.

On the trip back to China the Polos traveled through places which few people of other lands have visited even to this day. They crossed deserts and mountains almost uncrossable. But after three years they were back in the court of Kublai Khan.

Soon Marco Polo was a great favorite at court. He traveled widely in the land of the Great Khan. For a time, it is said, he even ruled one of the cities.

In those times China was far ahead of Europe in some ways. It had, for one thing, larger cities. One of its cities was the largest port in all the world. Its palaces had great parks around them. Some of the palaces had roofs of gold.

The Chinese already knew how to make paper. They were already printing with wooden blocks. They used paper money, which was much easier to carry than heavy coins. Fast runners took messages from one end of the kingdom to the other.

The Chinese had good roads. They had built the Great Wall and the Grand Canal. Sometimes for heat they burned a black rock—coal. Coal was little known in Europe then. They also knew of asbestos and made it into fireproof fabric.

The Khan liked the Polos so well that he did not want them to leave. But after many years the time seemed right for them to go. A Chinese princess was to become the bride of the khan of Persia. A party with a good leader had to go with her to Persia. Marco Polo was chosen as leader.

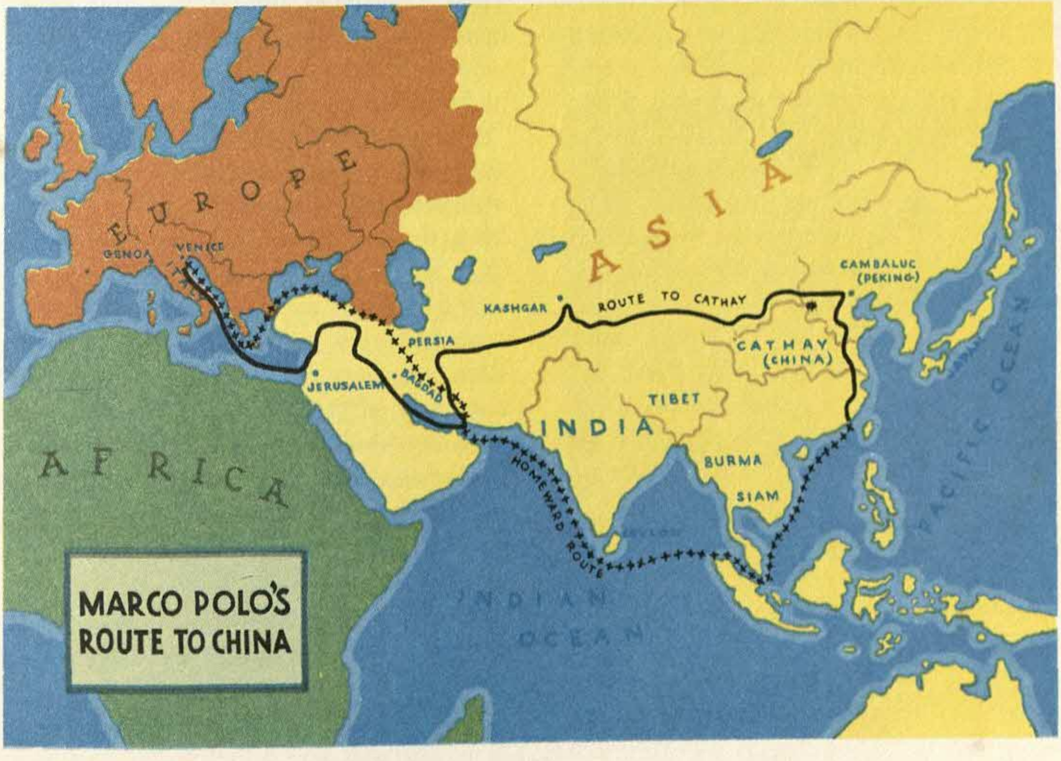
The journey home was mostly by boat. It lasted two years. But at the end the princess was safe in Persia, and the Polos were once more in Venice.

We might not know about Marco Polo's wonderful adventures if he had not been captured in a battle between Venice and Genoa. In prison in Genoa Marco told some of his adventures to another prisoner. This prisoner wrote them down.

Marco was soon freed. He lived to be 70 years old. Many people read his book, but not many of them believed it. Even some of his friends thought he had made up the stories. When he was dying they wanted him, it is said, to admit that the stories were lies. His answer was, "I have not told half of what I saw." Today we know that almost everything Marco Polo told about the lands he visited was true. (See ASBESTOS; COAL; GENGHIS KHAN; PAPER.)

MARGARINE Butter and margarine look and taste much alike. They are both mostly fat. But the fat in margarine does not come from cream as the fat in butter does. It may come from cottonseed oil, corn oil, or some other vegetable oil. It may come from whale oil or some other animal fat. Skimmed milk added gives a butter taste.

Margarine is much newer than butter. It was first made in France about 100 years ago. During a food shortage the French government offered a prize for a good substitute for butter. A French chemist won it by making margarine from beef suet.



MARKETING An automobile company would not make thousands of cars every year if these cars could not be sold. Tons of wheat from the great wheat fields of the United States would go to waste each year if they did not reach the people who need wheat in the form of bread and flour. The people of Africa buy relatively few of the diamonds from African diamond mines, but these diamonds finally reach customers in every city of the world.

The process by which the world's goods reach the people who want them is called marketing. Marketing has grown steadily over the years as world trade has grown.

A woman in Minnesota, let us say, who needs food for her family goes to a grocery store. There she will find baked goods, meats, fresh fruits and vegetables, canned foods, and many other things. Many of the products will be from other lands.

Before a grocer in Minnesota can have goods to sell, he must buy these things from someone else. But imagine what would happen if he had to buy pork from one farmer, beets from another, apples from another, and so on. He would have to buy from hundreds of men to get all the goods we find today in a large grocery store. Even after doing all this work he would still have no bananas, for instance, to sell. No farmers in any nearby states raise bananas.

Grocery stores, and most of the other stores we see, are called retail stores. They sell goods in small quantities directly to the people who will use them. Retail stores usually buy their goods from wholesalers. Wholesalers buy goods in large quantities and sell to retail stores just the amount that each store needs.

In big cities there are usually wholesale markets of many kinds. Those that sell fresh fruits and vegetables are very busy late at night when new produce is arriving, and early in the morning when grocers come to buy. These markets are big, busy, noisy places. Visitors often come to see them just to watch the activity.

Fruit and vegetable wholesalers buy their goods from packinghouses. The packinghouses buy directly from farmers. Because there are packinghouses, it is possible for a farmer to sell all of his crop in one place instead of taking it from store to store, selling a part in each place.

Here is the story of how some of our sweet corn gets from the farm to our tables. It is similar for most other fresh foods.

When the corn is ripe, the farmer picks it and rushes it to a packinghouse. There the corn is sorted according to quality and is packed in boxes. Trucks carry the boxed corn to wholesalers in cities. There the corn is bought by grocers. A housewife buys some corn from her grocer and takes it home. It may be on her family's dinner table less than 24 hours after the farmer picked it in his field.

Many other kinds of stores buy their goods from wholesalers. Drugstores, for instance, buy practically all their goods from drug wholesalers. These wholesalers buy from manufacturers or from men called jobbers, who may represent several manufacturers. Clothing stores, hardware stores, jewelry stores, and toy stores also buy most of their goods from wholesalers.

A few kinds of retail stores buy directly from manufacturers rather than from wholesalers. The dealers who sell cars, for example, buy the cars they need directly from the factories.

The process called marketing is very important in the busy trade of modern times. Millions of people earn their living in the many jobs marketing has to offer.

MARQUETTE, JACQUES (1637-1675) Before Columbus came to the New World the only people there besides the Eskimos were Indians. Some of the early explorers treated the Indians very badly. But there were some who were good to them. Father Marquette was one who treated them well.

Marquette was a French priest. He came to America as a missionary.

At first Father Marquette stayed at a mission in Quebec. He learned the languages of several Indian tribes. Then he went west to work with the Indians who lived near the Great Lakes. From these Indians Marquette heard of a great river farther west.

The governor of New France, the French lands in the New World, had heard of this river, too. He decided to send an expedition to find out about it. The governor chose Louis Joliet, a fur trader, to lead this expedition. Joliet asked Father Marquette to go with him as a missionary.

Joliet and Marquette reached the Mississippi by traveling down the Wisconsin River in birch-bark canoes. They were thrilled by the great river. On their journey along it they stopped at many places. Everywhere the Indians were friendly.

The explorers passed the mouths of the Illinois, the Missouri, and the Ohio, and came at last to the Arkansas. Friendly Indians there told them that they could reach the Gulf in about ten days. But they also warned them that the Indians to the south were unfriendly. The Spanish explorers in that region had been cruel. Joliet and Marquette decided to turn homeward.

On the long, hard trip up the river Marquette became ill. When they reached Green Bay, Marquette stayed behind at the mission there. Joliet went on without him to report to the governor.

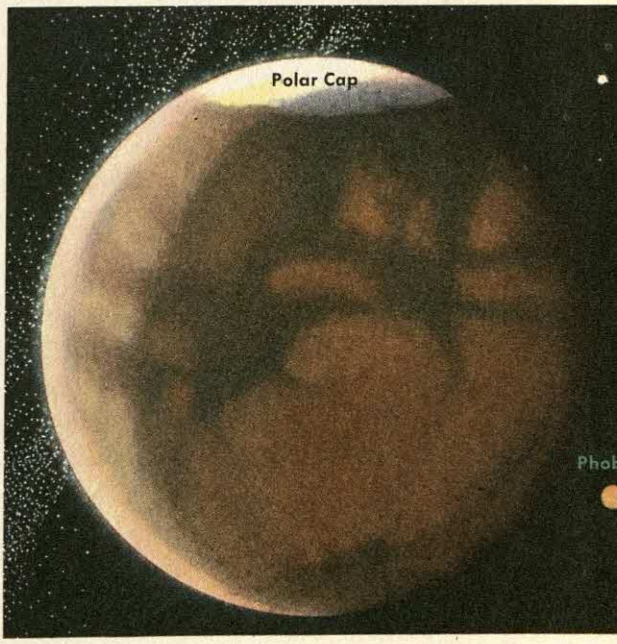
As soon as he was able, Marquette set out to build a mission for the Illinois Indians. He lived only to start the mission. To the end he and the Indians were friends (See EXPLORERS; JOLIET, LOUIS.)

MARS Eight planets besides the earth circle the sun. Of the eight Mars comes closer to us than any other except Venus. At its closest, about 35,000,000 miles away, the whole side toward the earth is lighted up. Excellent pictures can be taken of it.

The diameter of Mars is not much more than half the diameter of the earth. Its day is just a little longer than the earth's day, but its year is nearly twice as long as ours. Mars has two tiny moons, Deimos and Phobos.

For years there has been talk of Martians. Actually there is far too little oxygen, if any at all, on this small planet for creatures like us. There is, however, some suggestion of life there. Greenish patches that appear in the Martian spring may be very simple plants.

In 1965 the unmanned satellite Mariner IV flew close to Mars. It sent many pictures back to earth. As scientists expected, the pictures did not furnish any information about life on Mars—they were all taken from too far above its surface. The surface looked as barren as that of the moon. And it proved to be like the moon's in this way, too: it is pockmarked with craters. (See PLANETS; SOLAR SYSTEM.)



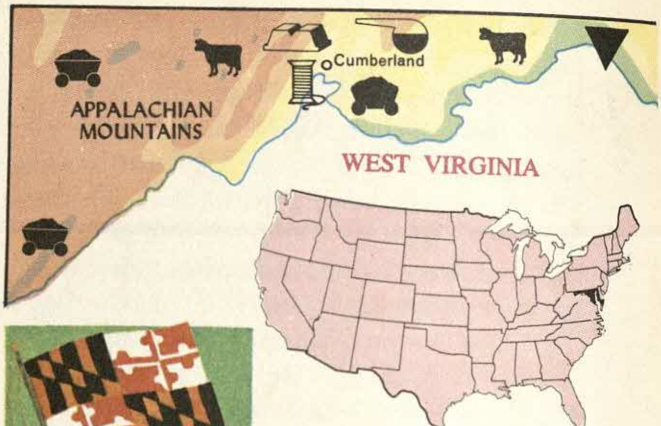
MARYLAND In 1632 King Charles I of England granted land in America to the first Lord Baltimore, one of the gentlemen in his court. A large part of this land became the colony of Maryland. The colony was named in honor of the English queen, Henrietta Maria. Most of the early settlers in Maryland were Catholics. But all settlers, regardless of their faith, were welcomed to the colony.

Maryland is called the "Old Line State" because during the Revolutionary War its troops gained high praise for holding the line against the British. After the war, in 1788, Maryland joined the Union as the 7th state. Its capital is Annapolis. This city served as the capital of the 13 states under the Articles of Confederation before the United States Constitution was adopted.

Since 1845 Annapolis has been the home of the United States Naval Academy. Thousands of young men have received their schooling here to become officers in the Navy. Among famous Marylanders were John Paul Jones, a sea captain in the Revolution, and Francis Scott Key, composer of "The Star-Spangled Banner."

When Washington was president, Maryland granted to the United States land along the banks of the Potomac for a capital city. Washington, D.C., was built there.

For many years Maryland colonists lived on the coastal lowlands, close to the rivers that flow into Chesapeake Bay. These streams served as highways for travel and trade. The settlers lived on large plantations cleared from the forests by their slaves. Their big, comfortable homes were built of brick brought from England. Ocean vessels from England came up the rivers on high tide to the plantation docks. There the planters exchanged tobacco for English goods such as clothing, furniture, and tools. Tobacco brought a good price and for a time was used as money.



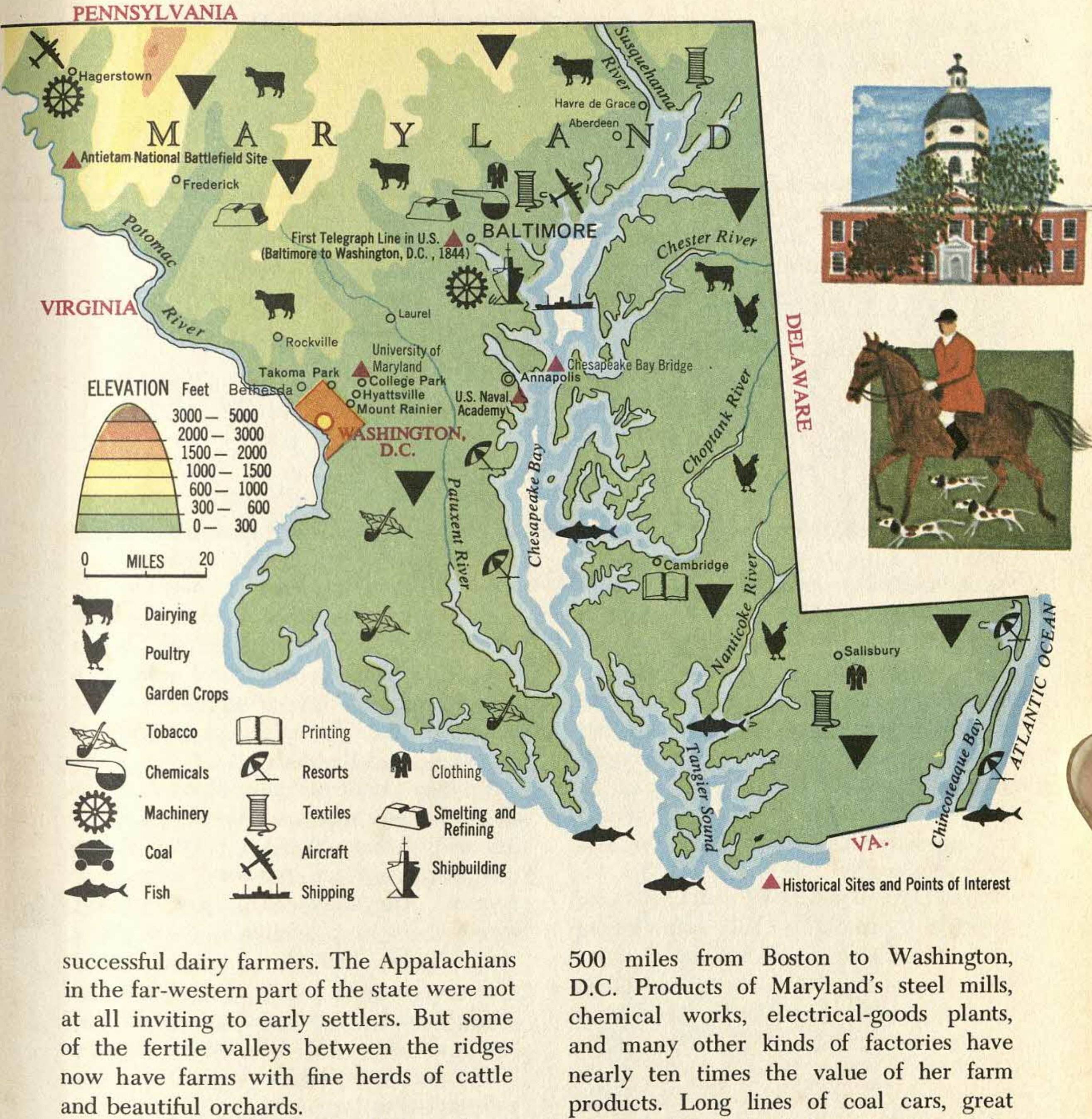
Total state population . . 3,613,000
Area (square miles) 10,557

State Bird: Baltimore Oriole

State Flower: Black-eyed Susan

After slavery was abolished, the big plantations of the coastal lowlands had to be divided into smaller farms. Tobacco is still grown on many of the farms. But fruits and vegetables are just as important today. The big peninsula east of Chesapeake Bay is called Delmarva because it is made up of parts of the states of *Del*aware, *Mar*yland, and *V*irgini*a*. On the sandy soils of Delmarva, with the help of fertilizers farmers raise enormous crops of tomatoes, lettuce, cabbage, potatoes, spinach, and asparagus. These vegetables are sent to city markets, packinghouses, and canneries. Many are rushed to quick-freeze plants.

After the lowlands were fairly well settled, settlers took up land on the rolling hills farther west. Many of them became

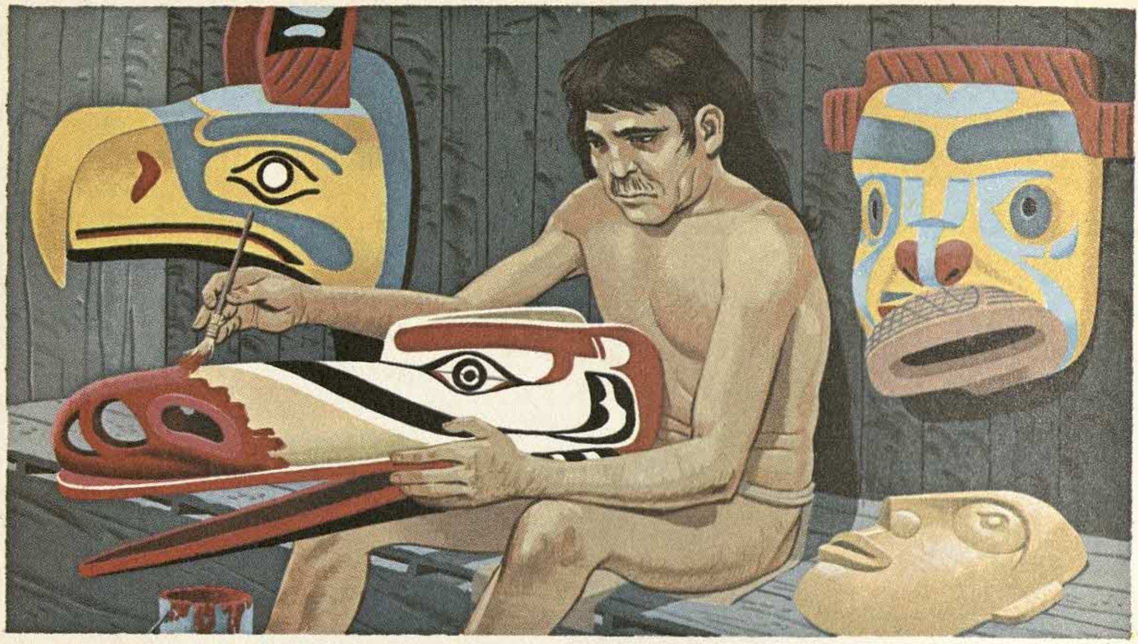


successful dairy farmers. The Appalachians in the far-western part of the state were not at all inviting to early settlers. But some of the fertile valleys between the ridges now have farms with fine herds of cattle and beautiful orchards.

The fisheries of Maryland have been important since colonial days. Chesapeake Bay supplies more oysters, crabs, and other shellfish than any other bay of its size in the world.

Time has brought many changes to Maryland. This small state, 42nd in size, is 19th in population. It is thickly settled. The Baltimore area is in the southern part of an almost continuous city stretching for 500 miles from Boston to Washington, D.C. Products of Maryland's steel mills, chemical works, electrical-goods plants, and many other kinds of factories have nearly ten times the value of her farm products. Long lines of coal cars, great ocean freighters, and huge trucks on the highways all are signs of the importance of trade. Baltimore, the state's largest city, has almost 1,000,000 people. No other Maryland city is a tenth as big.

The state motto is the Italian motto of the Baltimore family. It means "Manly deeds, womanly words." The white oak is the state tree. The state song is "Maryland, My Maryland."



MASK At Halloween many boys and girls parade about wearing masks. In carnivals like the Mardi Gras in New Orleans many people wear masks. Most of us think of masks just as fun. But some masks are worn to serve useful purposes. Those doctors and nurses wear in surgery, for example, and the gas masks soldiers carry are not worn for fun. Neither are the masks that are made and worn by many primitive peoples of the world.

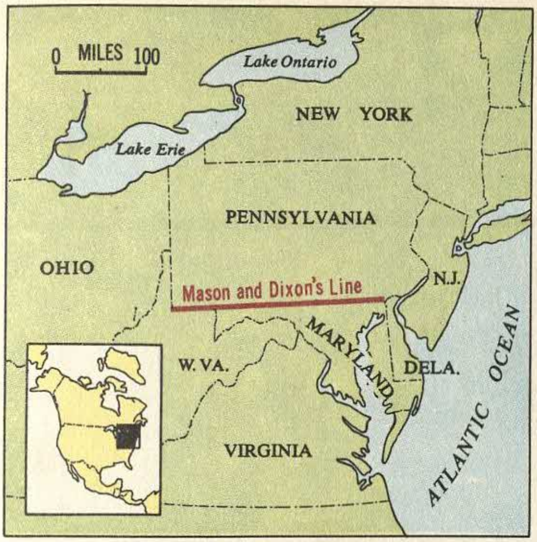
Among primitive peoples masks are used in religious ceremonies. They make a kind of link between a person and his gods. Dancers wearing masks go through dances that are prayers for rain. Medicine men wear masks when they try to drive out the evil spirits from people who are sick. Masks are also worn in tribal ceremonies when a boy reaches manhood. In war dances, too, the dancers often wear masks.

Some of the American Indians make remarkable masks. Many of those made by Indians of the Northwest Coast have moving parts. Animals are important in the religion of these people. Some of their masks are double. The outer part may look like a bird, the inner part like a face. The wearer pulls a string to open the outer mask and show the face. Among the Iroquois Indians in eastern United States some members, a secret group known as the False Face Society, make and wear grotesque masks to drive away demons that harm the tribe. The masks are supposed to be the faces of the demons.

Masks are made of many different materials. Halloween masks are usually made of stiffened cloth, rubber, or plastic. Primitive peoples do not, as a rule, have these materials. They may use such stuff as wood, woven fibers, bark, leather, feathers, shells, copper, gold, cornhusks, or coconut shells. A few even make masks of actual human skulls. Corncobs make good noses and horsehair good heads of hair. Many wooden masks are beautifully carved. Often they are painted or lacquered.

Many of the masks made by primitive peoples are bright-colored. The colors may not be just for decoration. Each color may mean something. To one tribe, for instance, yellow stands for rain.

In the early days of the theater, actors wore masks. Greek actors had different masks for tragedies and comedies. In countries of the Far East some actors wear masks today. (See HALLOWEEN; THEATER.)



MASON AND DIXON'S LINE About two hundred years ago Charles Mason and Jeremiah Dixon, two English surveyors, were called in to help settle a quarrel. The quarrel was about the boundary line between Pennsylvania and Maryland.

In 1632 Charles I, the king of England, gave the land that became Maryland to Lord Baltimore. In 1681, nearly 50 years later, Charles II gave the land that became Pennsylvania to William Penn. And the following year he gave Penn the land on the Delaware Peninsula that afterwards became Delaware. After many settlers had come to the colonies of Maryland and Pennsylvania, there were disputes about the line dividing them. Finally, in 1763, they agreed to let Mason and Dixon survey the line and set up milestone markers. Every fifth marker carried the arms of Penn on one side and those of Lord Baltimore on the other.

Later, people thought of this line as going on westward, far beyond the Ohio River. It came to mean an imaginary line dividing the states where there were slaves from the states where there were none. In the Civil War it roughly divided the North from the South.

Some people think that Dixie, a name for the South, came from Dixon. But there are other more likely explanations of how the name Dixie came about.

MASQUE At first masques were pageants in which all the performers wore masks. The idea of this kind of pageant was brought to England from Italy in the 1500's. The performers did not speak, but there was much singing and dancing. The costumes and settings were beautiful. Usually masques were given, not in theaters, but in the castles and courtyards of nobles.

Later the actors had speaking parts, and the masques were more like plays. One of the best-known masques is the *Masque of Queenes,* written by Ben Jonson, a popular poet of Shakespeare's time. Many people think that Milton's *Comus* is the greatest masque ever written. (See THEATER.)

MASQUERADE The word "masquerade" comes from the French word for "mask." A masquerade is a party or carnival where people wear masks and fancy costumes to keep others from knowing who they are. Masquerades are a part of the famous Mardi Gras carnival in New Orleans. Much of the fun of a masquerade comes when everyone takes off his mask. There are almost sure to be some surprises.

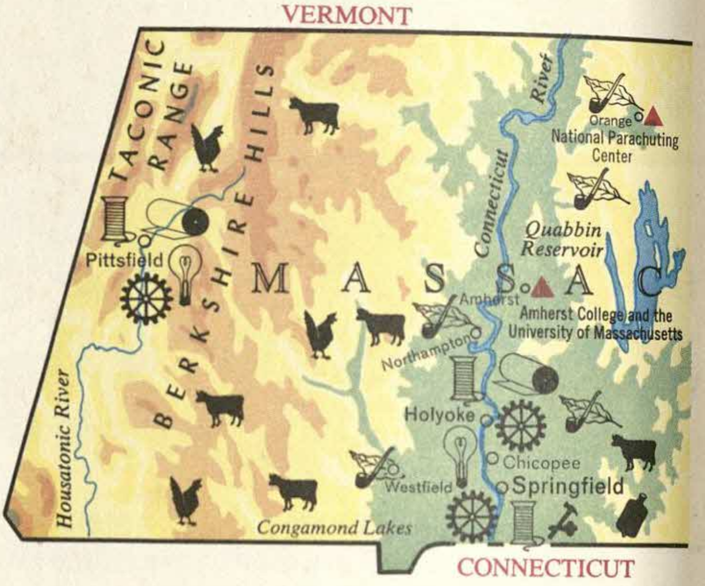
MASSACHUSETTS This state lies in northeastern United States in a region which John Smith in 1614 named New England. John Smith also gave Massachusetts its name. He named it for an Indian tribe he found there. The name means "at the big hill."

Massachusetts rises from sandy coastal lowlands to the wooded Berkshire Hills. Its coastline forms a number of bays, and a long hook of land, Cape Cod, extends out into the Atlantic. Massachusetts is often called the "Bay State." Another nickname is "Old Colony State." Massachusetts was the second of the 13 English colonies in America.

The Pilgrims, who landed at Plymouth Rock in 1620, began the settlement of the Massachusetts country. By 1640 many groups of English families had arrived and settled on the shores of Massachusetts Bay. In time the different settlements united to form one colony. For the most part, the settlers had come to America to seek religious freedom and more of a chance to govern themselves than the old World gave them.

The desire to learn led these colonists to set up the first tax-supported schools, the first college, the first library, and the first newspaper in the colonies. At their town meetings they learned much about how to govern themselves.

In the struggle for independence Massachusetts furnished many leaders and patriots. Among them were Samuel Adams, James Otis, John Hancock, and Paul Revere. The colony provided many soldiers and supplies throughout the Revolutionary War. In 1788 Massachusetts joined the Union and became the sixth state. The first society against slavery was formed in Massachusetts in 1832. Three native sons became president—John Adams, John Quincy Adams, and John F. Kennedy. The state motto is in Latin. It means, "By the sword we seek peace, but peace only under liberty."



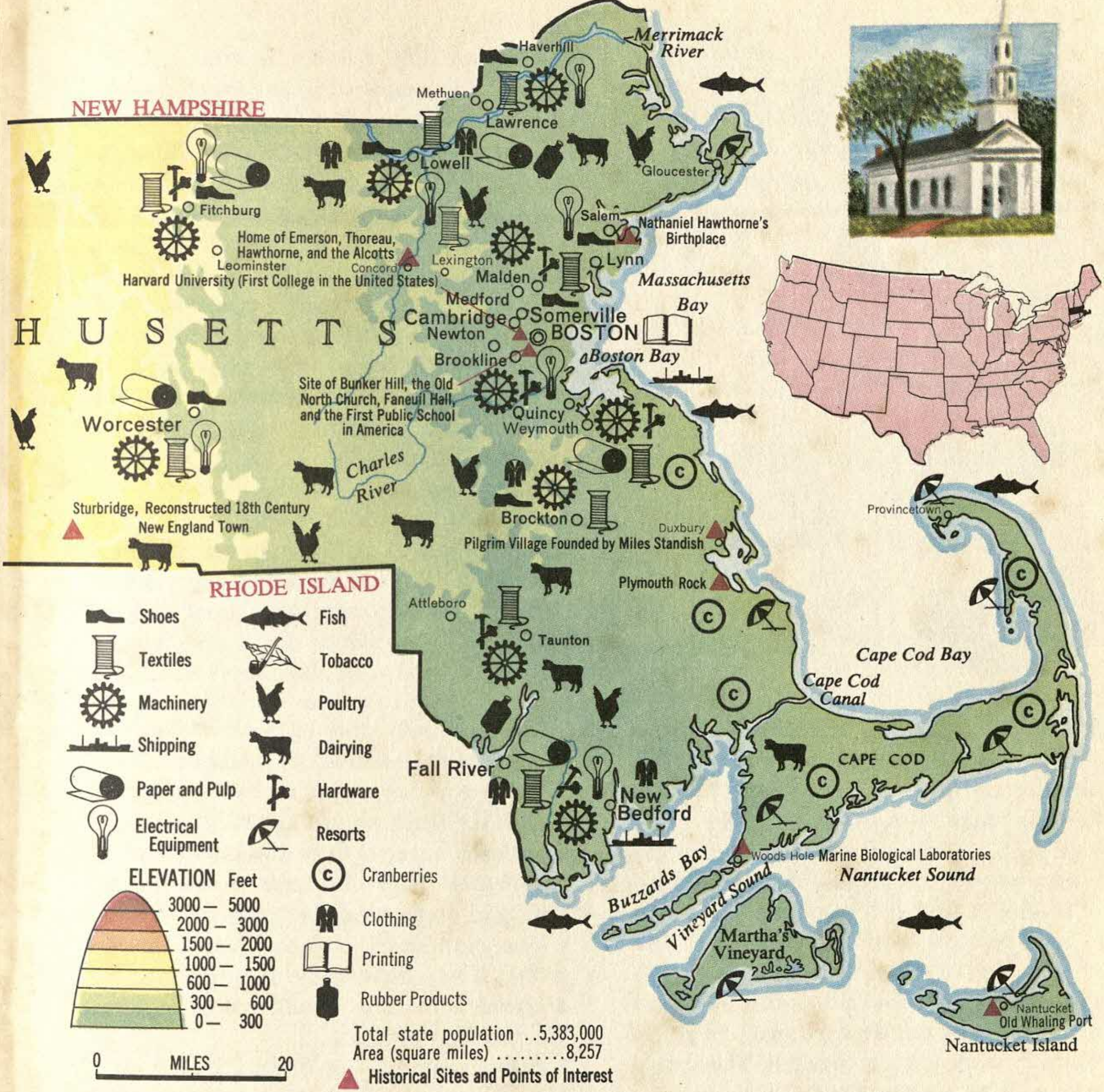
State Bird: Chickadee

State Flower: Trailing Arbutus

"Mayflower II"

The early Bay colonists used both the land and the sea to earn a living. It was hard to farm on the coastal plains. The soil was poor and some of the lowland was marshy. It was not so hard to get a living from the sea. Men did well by cod fishing and whaling. Shipbuilding and ocean trading gave many work.

In time some people made their homes on farms and in villages inland. Much of the land was hilly, stony, and heavily wooded. Life was hard on these farms, too. Skilled workers began to use the water of many streams to operate small factories making woolen and cotton goods, leather, and shoes. Mill towns developed.



Despite handicaps Massachusetts grew rapidly. At the time of the first United States census, in 1790, it had almost 400,000 people and was more thickly settled than any other state. Today this small state, which would fit into Alaska 71 times, has over 5,000,000 people. It is still one of the more thickly peopled states. Almost nine out of ten of its people live in cities. There are prosperous dairy farms, located mainly in river valleys. Fishing has grown into a rich seafoods industry. Massachusetts is among the ten leading manufacturing states, ranking first in shoes and other leather goods. Boston, with more than 600,000 people, is the state's largest city. Among the other big cities are Worcester, Springfield, and Cambridge.

Massachusetts continues to attract people to its cities and countryside. Some come as vacationers to get the feel of its past and to enjoy its shores and woodlands. Others come to study at such schools as Harvard, Massachusetts Institute of Technology, Wellesley, and Smith. Boston is the "Hub" of New England.

MATCHES Common matches are small and may not seem very important. But they save a great deal of time and trouble. Before the days of matches, lighting a fire took such a long time that people often went a long way to borrow hot coals instead of kindling a fire for themselves.

Long ago the Romans coated the ends of splints of wood with melted sulfur. Sulfur burns easily. The splints of wood were handy for carrying fire from place to place. But they were not real matches. They could not be lit by striking them.

Spunks, which were much in use 200 years ago, were also splints of wood with sulfur tips. They had such a bad smell that storekeepers did not want to sell them. Spunks, too, were good only for carrying fire from place to place.

Early in the 19th century a Frenchman invented the "instantaneous light box." A splint of wood had a head made of a mixture of chemicals. The head was lighted by holding it in a bottle filled with asbestos soaked in strong acid. The instantaneous light box did not always work well.

Today we light matches by striking them. Striking them means rubbing them rapidly on some rough surface. The friction makes the head of the match hot enough to catch fire and start the stick burning.

The first matches that could be lighted by friction were made in 1827 by John Walker, an English druggist. Walker knew that fires have to have oxygen. He had the idea that he could make a good match head by mixing sulfur with a chemical that gives off oxygen when heated. His plan worked. His matches were lighted by drawing them through a fold of sandpaper. Such matches came to be called lucifers.

Phosphorus is much easier to light than sulfur. Before long phosphorus matches were made. But many workmen got a disease from working with phosphorus. Experiments were carried on for years. At last a usable compound of phosphorus was found that would not harm the workmen.

The two main kinds of matches now are strike-anywhere and safety matches.

Strike-anywhere matches can be lighted by striking them against any rough surface. The heads have in them the compound of phosphorus. They also have in them glass, glue, and a chemical that gives off oxygen.

The matchstick is coated with paraffin so that it will light easily. It is treated with a chemical so that it will not glow after the match is put out.

Safety matches can be struck only on a special surface. There is always a special strip on the matchbox or matchbook. The secret of a safety match is that the phosphorus—a safe form of it—is in this strip instead of in the heads of the matches. Rubbing a match against the strip sets a tiny, tiny bit of the phosphorus on fire. It lights the head of the match. Safety matches were first made in Sweden in 1844. Now they are common everywhere. Among special kinds of matches made today are waterproof matches. Their use is mainly by men in armed forces. (See FIRE; FRICTION; INVENTIONS; PHOSPHORUS; SULFUR.)

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